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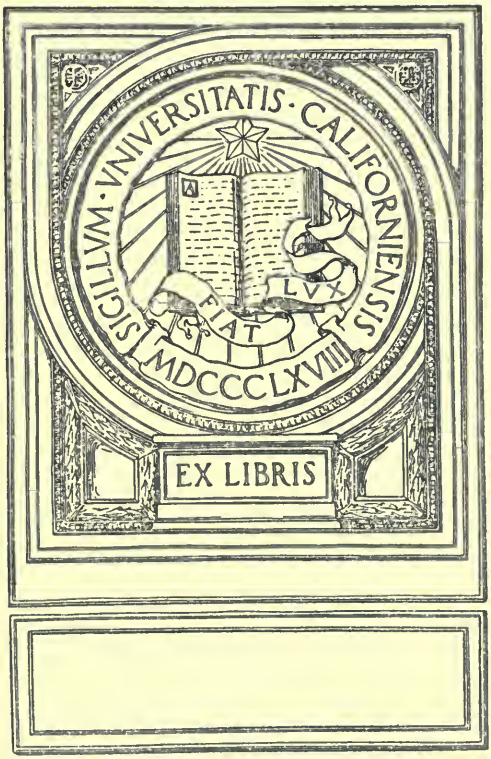

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Calvin Newton, M.D.

THORACIC DISEASES:

THEIR PATHOLOGY, DIAGNOSIS

AND TREATMENT.

By CALVIN NEWTON, A. M., M. D.,

Fellow of the Massachusetts Medical Society;—Professor of General and Special Pathology in the Worcester Medical Institution;—also in the Syracuse Medical College:—and late Professor of Rhetoric and Hebrew in Waterville College.

AND BY

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WITH A

BIOGRAPHICAL SKETCH

OF THE

LIFE AND CHARACTER OF PROFESSOR CALVIN NEWTON.

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PREFACE.

One object which Dr. Newton had in the preparation of this work, was to supply the increasing demand in the New School of Medicine, for a scientific treatise upon the Pathology, Diagnosis and Treatment of Thoracic Diseases ; and another was to make public the results of his own study and investigation into General and Special Pathology, and the means of Physical Diagnosis. Many new remedies, though in general use among the physicians of the New School, yet not in common use by the whole profession, are substituted for those upon which dependence has chiefly been placed for the removal of inflammatory diseases. That they are much more efficient, and at the same time less injurious to the constitution, a thorough trial will demonstrate. During nine years, Dr. Newton had given special attention to the study of thoracic diseases, and their treatment, and hence he could reasonably claim ample qualification to execute the task which he commenced. He had formed the plan for the whole work and had written all the general principles of pathology and diagnosis, and also, a particular description of several of the more important diseases of the thorax. Dr. Newton's writing ends on the two hundred and twenty-sixth page, at which place the writing of the Completing Author commences. In the completion of the work, the pathology, diagnosis and prognosis, have been chiefly derived from the best medical authorities of the age; and yet, such alterations have been made as investigation seemed to suggest. The treatment recommended, is substantially that of New School Authors, with such modifications as have seemed necessary, and of practical utility. Being a student of Dr. Newton in 1847 and 1848, and having been since that time associated with him in the practice and teaching of medicine during a limited period, good opportunities have been afforded for learning his peculiar views of the pathology and treatment of disease. From many other medical gentlemen of extensive experience much valuable information has been derived, to whom the Completing Author would here express his thanks for the interest which they have manifested in the work, and for their many voluntary contributions to the treatment of disease. In conclusion he would simply say, that he has used every possible effort to make the work valuable for the profession, to which it is now offered, with the hope that it may be the means of alleviating human suffering, and of the advancement of sound medical education.

Worcester, July 1854.

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BIOGRAPHICAL SKETCH

OF THE LIFE AND CHARACTER OF

CALVIN NEWTON, M. D.

Biographies of medical authors are seldom found in their works. Their professional appropriations to the science of medicine are their only public memorial. Many circumstances, however, make a historical sketch of the life of Professor Calvin Newton desirable, not only by his relatives and professional friends, but by that extensive circle of acquaintance that he formed during the period of his collegiate teaching, and clerical labors.

Calvin Newton was born in Southborough, Mass., on the 26th of November 1800. His father, Mr. Josiah Newton, was a respectable farmer and revolutionary soldier who held many town offices, and the deaconship of the Congregational Church in his native parish. His mother, Mrs. Elizabeth Haynes Newton, a lady of benevolence and piety, still lives in Ashland. His origin was from a family remarkable for longevity and characterized by a full mental and physical development.

In early life he manifested superior powers of mind. At the age of eight years he commenced the study of English Grammar, under the instruction of his older brother, Rev. Gideon J. Newton, who says, "he easily comprehended the ideas of authors, so that he soon was prepared to enter the first class of Grammarians." In the science of numbers, he had few successful competitors; in every study he was thorough, deducing the general from the particular, and easily recognizing the relations of the various branches of knowledge. Possessing the "high purpose," "the firm resolve," and "the clear conception,"—the elements of success in literary pursuits,—he improved every opportunity for mental culture, the school vacation, the winter's eve-

ning, the summer's morning. While others sported, he studied, while others slept the sleep of the sluggard, he sought the society of those golden records written by the genius of every country and of every age. To receive instruction was his pleasure, to impart it, his delight. A youth of sixteen he commenced teaching in a village school, and soon after the study of the classics with the clergyman of his native parish. At Framingham Academy, he completed his preparation for college.

In 1820, he entered Brown University, where he remained nearly two years, until the death of his father deprived him of the means with which to complete his collegiate course. The sudden removal of that dear object of filial affection made a deep and lasting impression on his mind. Reflection followed and that most desirable of all moral changes, the honest and sincere consecration of his talents and acquirements to the service of God. Intimately connected with these events of his life, is another, deserving a passing notice. Of this I have often heard him speak with the simplicity of a child, while the tear of grateful remembrance told the deep emotions of his soul. "I can never speak" says he, "of the benevolent act of Col. Dexter Fay, of Hon. Francis B. Fay, and of Hon. Sullivan Fay, in lending me the means with which to complete my collegiate course, without yielding up reason to the guidance of feeling."

Freed from pecuniary embarrassment, he returned to Brown University, and there completed his junior year. Subsequently he went to Union College, where he received the degree of Bachelor of Arts in the year 1826, and afterward that of Master of Arts in the year 1829. During his senior year, he taught a high school in Worcester, and at the same time pursued his collegiate studies. The means thus acquired being sufficient in amount, were immediately used for the payment of his borrowed money. While engaged in teaching, he was convinced that duty called him to the work of the Christian ministry. Previously a member of a church in Providence, he then united with the Baptist Church in Southborough, from which he received a license to enter upon the duties of the clerical profession. In 1826 he commenced the study of Divinity in Newton Theological Seminary, and in 1829, received the highest honors of that Institution. During the pursuit of his theological studies, he frequently preached in the Baptist Church at Bellingham, and in 1828, October 22nd, he was ordained its Pastor.

While at Framingham Academy, he had formed an acquaintance with Miss Millisent Johnson, an intellectual and religious lady. About the time of his settlement in Bellingham, they were married. To him she ever proved a devoted and faithful companion, and although he, on account of her ill-health during the latter years of his life, expected to follow her to the tomb, yet she suddenly deprived of the object of her affection, still lingers on the verge of the grave.

In 1832 he was elected to the Professorship of Rhetoric and Hebrew in Waterville College. After remaining there five years, he was elected President and one of the Professors in the Theological Institution, first established at Charleston Me., but afterward removed to Thomaston.

He was connected with this Institution four years. Subsequently he became the Pastor of the Baptist Church in Grafton, Mass., where he remained about three years, until declining health induced him to change his profession.

In early boyhood he manifested interest in the science and practice of medicine; and although later in life, his moral sense pointed out another path of duty, yet he perceived the necessity for a radical and salutary change in the cure of disease. In the conservatism of the University, he saw the bias of antiquity; in the common sense suggestions of the untutored mind an occasional gleam of truth; in the former, the ornament and symmetry of science, in the latter the practical wisdom of unchained genius. Midway between these extremes bright and safe appeared the course of reason, great and enduring the improvements to which it leads. Although educated at the University at Cambridge and the Berkshire Medical Institution, yet he was uninfluenced by their conservative spirit. Free from prejudice, not biased by sect or creed, he sought to interrogate nature in the language of science, and to rightly interpret every phenomena which she presents. After the manner of inductive philosophy he sought to deduce from facts some general principle, to guide the physician in the cure of disease.

After graduating at the Berkshire Medical College, and his admission into the Massachusetts Medical Society, he commenced the practice of his profession in Worcester. During the whole course of his medical study, he gave special attention to every new remedy and process of cure, which promised to become an improvement. With interest he heard of the dis-

coveries of that rustic Son of New Hampshire ; how that in many cases his simple vegetable remedies were more successful when prescribed by the hand of ignorance—than the common remedies when prescribed by the hand of science. Not believing in all his crudities, he, nevertheless, saw in the simple process of applying medicine, and in the changes in the Materia Medica suggested by Thomson, a germ whose future development, by the fostering care of science would become to the world an inestimable blessing.

Opportunities for the administration of the new remedies were improved, in order to test their efficacy, and ascertain the extent of their healing power. Confidence followed experiment, and a firm determination to place their utility in a conspicuous position before the world, succeeded the conviction of reason. Following the example of Galen, he sought to combine the practical wisdom of Hippocrates and the rigid logic of Aristotle, and also, to add to their attainments the treasures of modern discovery and invention. He had no blind reverence for the authority of names. "Hereafter," he remarks, in an address to his classmates of the Berkshire Medical Institution, "it will not be sufficient to refer to authority in support of a particular practice. In the eye of the discerning, it matters not, whether error is old, and has the sanction of distinguished names, or is new and unauthorized. The poisonous draught is none the less bitter for having been already tasted by numbers. It is now becoming fashionable, in the community to bring every thing to the test of experience. We must have the why and the wherefore to sustain any measure ; and, with the greatest reluctance, only can we admit what is incapable of proof, to have science for its basis. Plain common sense comprehending in a measure the nature of disease, and proving by observation and experience what medicines will do, is it not to be put aside by any reference to the history of remedies, and what has been thought in times past to be their action. Many, however, have even up to the present time, seemed to suppose that the authority of names was all the support their practice required ; and with them a reference to Cullen or Brown, or other distinguished individuals, is of more importance than an overwhelming host of facts. With such persons, in truth, all investigation is proscribed ; whereas we are beginning to learn, that to the test of close scrutiny everything claiming to be science must be brought."

With such liberal views of medicine, he entered upon its practical duties

Around him on the one hand were the representations of Allopathy, on the other a few pioneers of medical reform. To the progressive party, he mainly looked for sympathy and support, into its ranks he proposed to introduce the benefits of scientific study. Himself the recipient of thorough literary culture and medical education, he knew their utility, and realized the benefit that their possession confers. Than himself, in these respects, none were better qualified to lead minds, but imperfectly educated up to higher stations of medical attainment. Why was medical reform generally unapproved by the literati, and aristocracy of New England? Why had its adherents such an amount of prejudice, such bitter opposition to overcome? One reason, doubtless was, the tendency of the human mind to condemn the new, especially when its origin is humble; another, the manner in which reform was advocated. With it were associated the ideas that every man can be his own physician, that one course of treatment is adapted to every form of disease, that "heat is life, and cold is death."

To successfully bring to the notice of the profession a new remedy or new course of treatment, requires its presentation through a certain channel of influence. Had the simple remedies of Thomson and those of other early reformers, and their simple course of medication unconnected with other things obnoxious to the general sentiment of mankind, been used and recommended, in some of those foci of influence which glow high up the hillside of science, long since their merits would have been disclosed, and their benefits have brought joy to the afflicted in all the city streets. The truth of this, Dr. Newton fully perceived. The remedies were good, a great improvement upon those in general use, but the fact must be told from portals of science, in order to quickly influence the world. He, therefore, resolved to free if possible, the reform part of the profession from their ignorance, to divest it of the forms of charlatanism, which to some extent it had assumed, and thus to place it on a basis fixed and immovable as the rock of scientific truth. What more useful enterprise, what nobler object could occupy the attention and kindle the zeal of a liberal and educated mind? To effect such a result, to his mind two things seemed necessary:—A Medical Institution, and Medical Journal, both conducted scientifically, yet advocating all the improvements that discovery might suggest.

Accordingly on the first of January 1846, he commenced the publication

of the New England Medical Eclectic and Guide to Health. Portions of his editorial address contain the best exposition of his objects and principles :—

"Many *pathies* and *isms* in medicine are prevalent at the present day Besides allopathy or the old practice, we have homœopathy, hydropathy, Beachism, Thomsonism, &c.; and those who are solicited to be our readers, will wish to know, as we suppose, under what colors we intend to sail. In answer to the inquiry, then, we say, Our flag is our own. Our object is the extension of medical truth. We are pledged to sustain no class of physicians or mode of practice, except such as we are directed to by reason, science, and common sense. We belong, indeed, to the Massachusetts Medical Society, and are in fellowship with our medical brethren; but we, like them, are at liberty to use such remedies in the removal of disease as we judge to be the most efficacious. We are inflexibly opposed to every form of quackery; but we do not believe that medicine, unlike all other sciences and professions, is incapable of improvement. We believe that much yet remains to be done in developing the principles and carrying out the practice of the healing art; and, if we can get at truth, we care not from what quarter it springs. We shall never hesitate to adopt any Indian remedy or old woman's prescription, when,—its nature and *modus operandi* being shown,—we have the evidence, that its good effects must be superior to those of any article now officinal. Time has been when some good thing came out of Nazareth; and we believe it eminently true in medicine that valuable improvements have arisen from obscure sources. In vain, therefore, do those who have enjoyed superior professional advantages, say, "We are the people, and wisdom shall die with us." Those who stand at a distance in the outer court of science, are sometimes as genuine and acceptable, if not as exalted worshipers, as others who are permitted to enter the inmost temple; and we shall try, according to our motto, to

"Seize upon truth, wherever found,
On Christian or on Heathen ground."

"It may be objected, that the tendency of our Periodical will be to spread out medical information too broadcast over the community. To this we reply, we have no wish for the matters of our profession to be kept, like the mysteries of Egyptian priests, secluded from all but the initiated. We do

not, indeed, accord with Samuel Thomson in the belief, that every man can, with propriety, be his own physician, any more than we believe, that every farmer can, with advantage, be his own carpenter, or blacksmith, or watchmaker. Every man, it is true, can, in a sense, be all these for himself; but he will certainly be a clumsy performer, so long as he attempts to do a little of every thing, and gains a competent acquaintance with nothing. The science on which the practice of medicine is founded,—the knowledge of the human system, the nature and operation of remedies, and the like, are matters not understood, to the degree requisite for the physician, without long and arduous study. Still it is evident, that, to some extent, these matters may be brought distinctly before the minds of the common people, and made level to the capacities of all; and immeasurably better would it be for children and the various members of the family circle to employ their leisure hours in becoming acquainted with their physical systems, and with the means of promoting their health, than in dissipating their minds and corrupting their morals, with fictitious stories and wild romances. Our endeavor, therefore, will be the wide dissemination of medical truth; and, were it possible, we would gladly be *professionally*, what one infinitely greater than ourselves was *morally* and *spiritually*, a light to enlighten "every man that cometh into the world."

"By those of our Thomsonian friends who "go the whole figure,"—as the phrase is,—we may be thought not sufficiently strenuous for Botanic principles. Some may even impugn our motives, and charge us with going between different parties for the sake of gaining favor with all. To such we put the question of Nicodemus of old. "Doth our law judge any man, before it hear him, and know what he doeth?" Or, again, we reply in the language of one of Cæsar's procurators, resident at Cessarea, "It is not the manner of the Romans to deliver any man to die, before that he which is accused meets the accusers face to face, and have license to answer for himself concerning the crime laid against him." If the Eclectic is not essentially *orthodox*, even in the judgment of the most radical Botanic, then, and not till then, let us be condemned for *heresy*. If, indeed, any expect of us a constant warfare with diplomatized physicians, they are destined to disappointment; for we do not believe, that, by that medium, much medical truth is, or can be communicated. Were we, or any member of our family, dan-

gerously ill, we confess, that we should prize a plain description of the disease, with the means of recognizing it, and the mode of applying such remedies as would speedily effect a cure, far more highly than even the most eloquent tirade or phillipic against the errors of the schools. And, besides, we must plead, in our own behalf, the peculiarity of our phrenological development. Our *organ of combativeness* is not large, and it is extremely difficult for us to be pugnacious. We think it better to love even our enemies; and to trust to the correctness of the maxim, "Truth is great, and will prevail." Very few, at the present day, we believe, will sympathize much with a neighbor of ours who calls himself a doctor, and who recently avowed to a friend, that "an educated physician and an educated minister are good for nothing; and that, if we would have a good physician or a good minister, we must take a man directly from the plough." We would not conceal the truth, that we like to have physicians and ministers, as well as mechanics, merchants, and others, educated for their respective employments; and we cannot help thinking, that the fable of the fox that lost his tail, has its moral in the case of the neighbor referred to. True it is, that in medicine, as in every thing else, one may be taught error; and, under erroneous instructions, he may have his mind misdirected, and his judgment perverted; but, this affords no argument whatever against a correct education. It is the error inculcated, and not truth, which works the evil. The medical student has only to take the path marked out by reason, science, and common sense; and then, the farther he advances, the better practitioner will he be. According to our views, empiricism,—whether in or out of the regular profession,—diplomatized or not,—has its foundation in ignorance and error. It is the lack of true professional knowledge, and not a redundancy, which makes the empiric, and sacrifices human life. Our watchword to every man who would be a good physician, will ever be, Onward, onward, in the path of truth. In this way, and in this only, will you honor your profession, and benefit your race. The time has come in which, to gain the confidence of the people, the medical practitioner must place himself on the platform of sound professional principles."

Such were his ideas of medicine, liberal, philosophical, reasonable. To diffuse them in the profession, and to impress them upon the minds of students, he ever labored.

In the same year the inceptive step for the establishment of a Medical College was taken. At a Convention of the friends of reform, a Board of Trustees was chosen, and Dr. Newton was elected Professor. An unsuccessful application to the Legislature for a charter, made it necessary for the Institution, in order to grant degrees, to act under the protecting ægis of the Botanico-Medical College of Georgia. At the end of the first course of lectures, debts had accumulated, which he and his co-laborer in reform, Dr. J. A. Andrews, generously paid.

The next course of Lectures in 1847, commenced, and progressed under circumstances somewhat more favorable; and although efforts were yearly made, no charter was obtained until the year 1849. Before a special committee appointed by the Senate, Dr. Newton presented the claims of the Worcester School, in opposition to the appeals made by a committee from the Massachusetts Medical Society, consisting of Dr. John Ware, Dr. Jacob Bigelow and Dr. Henry G. Clark, in order to prevent the legal existence of the Worcester Medical Institution. Dr. Newton, however, was successful in the accomplishment of his object.

In 1847, the Eclectic took the name of the Journal, under which title it was published until the time of his death. For its support he yearly contributed his editorial services, and even made pecuniary sacrifices to keep it in existence.

In 1850, a College building was erected by the friends of the enterprise on Union Hill in the city of Worcester. For this, Dr. Newton freely contributed. "To the welfare of the Institution," he remarks "my heart and my life, are, and shall be unremittingly dedicated; and, when I go the way of all the earth, I hope to leave behind me, not merely a pecuniary legacy, that will supply some of the Institution's future wants, but a richer legacy of professional literature and science, embodied in medical works and instilled into the minds of hundreds and thousands of the profession."

The Institution from this time seemed more prosperous. The sessions of 1852 and 1853, were better attended—and hope seemed more than ever before to inspire the heart of its founder.

The establishment of a State Society was another object whose accomplishment seemed necessary to the success of medical reform. For this purpose, Dr. Newton, in 1850 was chosen chairman of a committee, by his

medical brethren to draft a constitution for the Massachusetts Physo-Medical Society. Rules and regulations were established, and regular meetings held, at which addresses were delivered, and topics of professional interest discussed.

In 1852 he attended the National Eclectic Medical Association at Rochester, N. Y., and was elected its President, and one of a committee to prepare an address for the next annual meeting at Philadelphia.

At Rochester he formed, while attending the Convention, many pleasing acquaintances with his medical brethren; he won their respect and proved to them amidst conflicting interests a nucleus of union. His election to the chair of General and Special Pathology in the Syracuse Medical College, induced him still more to labor for the production of harmonious action among the reformers of New York.

By the friends and students of the Syracuse Medical College, his Lectures were very highly approved, and many expressions of regard and affection were mingled with the sadness of the parting farewell.

A want of medical literature was another incentive exciting to action the mind of Dr. Newton. No works were extant written in a style purely scientific containing the treatment of reformers adapted to the pathology of the schools. He, therefore, retired from general practice, also resigned his chair at Syracuse and devoted his time exclusively to writing. After the completion of his work on Thoracic Diseases, he had formed the determination to visit Europe, in order to better qualify himself for the authorship of a work on Theory and Practice. But the room of the student was not his most healthful element. The bright sunlight of day, its toil and strife were far less injurious to his active and vigorous frame. From physical exercise his mental drew too much of his attention. The nervous system suffered. In the words of Prof. Reuben, "The insidious foe was lurking in the very springs of life, loosing the delicate affinities, and cutting off at their fountains the streams of vital force."

In the private relations of life, Dr. Newton was respected and honored. By the citizens he was elected one of the Common Council, a member of the Board of Aldermen, and was Secretary of the Board of Trustees of the Worcester Academy. A full enumeration of all the places of trust which he has occupied, and the little incidents connected with the fulfilment of his

official labors, would be interesting; but such is not my present purpose. A brief consideration of the more important points in his character will suffice. In doing this, I am well aware of the difficulties to be overcome, of the bias of friendly acquaintance. To love and reverence a teacher and friend, how pleasant! To analyze his character, how repugnant to the warm glow of affection! And yet the public weal demands an analysis of the characters of leading men, in order that their virtues may be imitated, and their faults avoided by those who succeed them on the changing stage of life.

Dr. Newton was a powerful man physically, a man of a large mould, a great body, and a great brain; his frame vigorous and well proportioned, every part alive with active, vital force. What a chest was his! what large pulmonary and digestive organs, those two factors of physical and mental power! From thence was derived his constant impetus to corporeal exertion, the fuel supplying the bright flame of thought. His personal appearance was not indicative of ornament, but of that physical strength and mental energy and decision which press right onward to their destined purpose. His intellect was strong and active.

The forms of intellectual action may be divided into three modes:—the Reason, Understanding and the Imagination; the Reason, dealing with universal laws, the philosophic power. The Understanding, with details, the practical power. The Imagination, with beauty, the Poet's gift.

Of Reason, Dr. Newton had a larger share than of the other intellectual endowments. He was a man of philosophic ideas, ever seeking to deduce from facts a law, general and universal. To generalize was his ambition, to strike out like Bacon, some new and shorter course to scientific improvement. His power of comprehension was uncommonly large. And hence, from his mind original ideas proceed. Originality may be divided into two kinds; originality in applying in a novel manner the knowledge of others, and that originality which brings forth the new principle, the new idea. This latter is not so dependent upon others' thoughts; it has a creative power of its own; within the boundaries of genius is the field of its labor. Viewing things subjectively, it moulds into its own likeness the external world. In its ideal creations are newness, and freshness, are forms of utility unseen by common minds. Traveling in untrodden paths, pursuing its diverse way into the dark labyrinths of the unknown, there from a spark of intellec-

tual agency it kindles the radiant flame of science. Of this latter kind Dr. Newton possessed the more, of the former the less. His ideas of disease were neither those of Allopathy, nor those of Thomsonism or Beachism; they were peculiarly "his own." He organized new associations of physicians, and moulded a system of successful medical empiricism into the form of scientific knowledge.

His Understanding was less than his Reason. Although he acquired readily and retained well, his perception was less acute than that of many minds inferior to his own. In adapting means to the accomplishment of an end, his large hope sometimes caused him to overlook many of those minor contingencies which mould and fashion results.

The secret of his success, lies mainly in his reason, in his comprehensive views of the subjects of medical study, in his indomitable perseverance, in his devotion *to one object*, in his spirit of self-sacrifice. To science he seems to have paid much attention, more than to general history and literature.

I cannot claim for him large imagination. His eloquence lacks the poetic charm, the beauty which makes luminous the page, and touches the heart of humanity. Two or three short poems are all that his poetic faculty has left. One on *Superstition*, has the following excellent lines:—

"Hail! Sacred knowledge. Freedom's purest Friend,
The richest boon which Heaven to earth could send.
Resplendent Orb, but late thy dawning ray,
Hath broke the horrors of a sunless day,
Soon may thy power, our languid spirits fire,
And Franklin's sons to classic heights aspire,
An Attic genius stamp our growing fame,
And wrest the Laurels even from Grecian name,
Then Superstition from the earth be cast,
Not least of evils, though to die the last."

His style was simple, the style of a strong, logical thinker. His theological writings, though sometimes dull, addressed to the reason, at times swell into beauty, and touch the conscience. When contending for some principle or for personal interests, his opponents often felt the keenness of his rebuke, and feared again to call forth his withering, caustic words. In his writings as in his life, there were no artful flourishes of rhetoric, nothing but the language of a naturally frank and honest hearted man.

All bombast in language felt the keen edge of his sarcasm, and of his judgment. No high sounding words could captivate his approval. In his lectures he was familiar, his illustrations simple, adapted to give the idea, rather than please the fancy.

Dr. Newton was a conscientious man. To the guidance of the Supreme Intelligence he intrusted all his interests. In every condition of life he was trust-worthy, never deceiving with subtle tongue, nor flattering the gross prejudice of the vicious and ignorant. Rather than resort to the duplicity which every where prevails around us, he chose to be deprived of many advantages which an unmanly policy often affords. Honest, open-hearted and unsuspecting himself, he sometimes gave his confidence to those not worthy of its reception.

He was ambitious to excel, ambitious to occupy that station for which his education and talents best fitted him. Would he have served under the banner of those who were his inferiors in qualification? would he submit to be transformed into an instrument whose use would elevate ignorance and quackery above himself? Dr. Newton's dignity and self-respect, could not be thus degraded. And if to exercise those qualities, is to be ambitious, then he may prove guilty to the charge. Such an ambition is worthy of all honor, and respect. That ambition which never feels, moves, acts, never makes humanity rejoice. His ambition then was one of the qualities which fitted him for the performance of the duties devolving upon the station which he occupied. Its results have added to the interests of progressive medicine, and, therefore, let reform be thankful that a shining light has illumined its rising pathway to usefulness and honor.

His affections were strong. When once entwined around their object, they were enduring and constant. He loved strongly, loved the qualities which make up the ideal of perfection, and in whomsoever these shone brightest and most constant, thither his affections were directed. Relatives and friends, neighbors and citizens loved him, for in him the good found enduring friendship. He never sought to betray for policy, nor loved to sacrifice the interests of others for personal aggrandizement. With him the just and good found sympathy. But the vicious, base, and jealous enemy, no regard and favor.

> "Lofty and sour to those that loved him not,
> But to those that sought him, sweet as summer."

He was a cheerful man, and loved to make company lively by the interchange of wit. His mirthfulness was peculiar, breaking out in that explosive hearty laugh, which will long be remembered by his friends and acquaintance.

Philanthropy was one of his qualities of mind. He heard the cry of the poor, and from his heart went forth the bright stream of sympathy and relief. Charity often entered his open purse, and took away that which avarice would hold with relentless grasp.

He was a religious man, a Christian in the highest sense of that word. For its external form, its pomp and show, he had less regard than for its inner life. His soul had been renewed, and away in the gloom of futurity, he saw the golden gate open for its reception. In all his actions he recognized an overruling Hand, and willingly submitted to Supreme dictation. In fine, his whole life shows that he had a large development of those religious faculties which join the hearts of the good to the Infinite God.

To principle more than to forms and ceremonies he was religiously devoted. For some benevolent purpose he labored, not for mere worldly gain, but for the purpose of gaining the approval of a smiling humanity. Having no children upon whom to bestow his care, he considered the Institution whose corner stone he laid, as worthy of his parental love and affection.

That he had faults no one will deny, and yet even for these there were many palliating circumstances. If he attempted too much, it was because he sought to rear a fabric of medical reform, and to complete the entire structure by the force of his own energy and genius. If he did not sympathize with all the ideas and customs of reformers, it was partly owing to his different culture, and different habits of thought.

Very few are the men whose faults are so few, whose virtues so many. The day may be long ere another, so faithful to principle, integrity and to science, will descend from seats of honor, to labor in an unpopular cause for the sake of doing good to the world.

A magnanimity of soul far transcending the little petty jealousies that divide the ranks of reform, is plainly shown by the events of his life.

At first we see him an ambitious and honest youth, obtaining the prize of intellectual valor at the common school; now teaching with one hand, with the other studying the classics, and now entering the University, and at the

end of two years, returning to his home to bid an affectionate father a last farewell; now cheered by the benevolence of his neighbors, now exulting in the joy of that hope which is as an anchor to the soul; then teaching a high school in Worcester, and next returning from Academic halls laden with the honors of science; now entering the theological seminary and devoting his talents and acquirements to the service of God, and now the village pastor; next the college professor, then the theological teacher, again a pastor, afterward a student of medicine, a practitioner, a professor and founder of a medical institution, an author; and finally we see him,

"The hale and strong, who cherished
Noble longings for the strife,
By the wayside fall and perish,
Weary with the march of life."

Born November 26th, 1800, he died of typhoid fever August 9th, 1853, died in the midst of useful labors, at a time when victory over difficulties was just before him.

But his life was not in vain; it was marked with achievements in the field of utility. He wrought a work which humanity will bless, for he labored for the interests of man; a work which heaven approves, for he sought to extend the religion of Christ. He had induced the student to press on in the path of knowledge and virtue; he had elevated the groveling ideas of youth, and had pointed them to the benefits of thorough mental culture in order to insure success in the practice of a profession; he had taught them to exercise their own faculties of mind, to think and investigate for themselves, rather than to depend upon the authority of others; he had taught the physician the importance of possessing an unblemished moral and religious character. Of these labors he began to receive the reward. His ideas of medicine began to enter the walks of the higher circles of society, inducing legal protection and securing popular favor. Before his decease, he had seen these indications of the speedy and final triumph of medical truth over prejudice and conservatism. If he did not complete the entire fabric, he formed and fashioned the plan, laid the corner stone and reared thereon the central pillar. The consciousness of having done so much for the good of mankind, must have lighted with joy the last moments of his existence. Life to him was desirable for its opportunities to do good to others, and his

regret was, that a disease should take him away from a field of labor in which he was conscious of conferring a lasting benefit upon the world.

Prophetic omens of the sad event had appeared. I was with him at Syracuse, his room-mate and colleague, and often heard him remark "My work is nearly done—adhere to me, carry out my plans." Death came though scarcely welcome. A few faithful friends and medical attendants gathered around him; upon them he called for aid, but for the cold touch of death there was no healing balm. His strength failed, delirium stirred up his brain, and again he hopefully talked of his College, his Journal, his Book. Finally, the silver cord was loosed and his soul rising to newness of life was calm and peaceful in the bosom of God.

Such was his life; his physical, vigorous, and energetic; his intellectual, in its onward flow constructs a more accessible pathway to scientific truth; his moral and religious, like a cone its apex at the earth, its base in the light of eternity is ever expanding, ever progressing in the bright sunbeams of the Pure Intelligence.

He is no longer a citizen of earth; but

> There is a happier clime,
> A larger and a purer life, unknown to earth and time,
> A clime with light ineffable, unveiled by midnight gloom,
> Beside whose living streams the fairest flowers perennial bloom;
> A clime beyond the circling stars, the floating cloud, the sky,
> All radiant with its glowing hues; there all beneath it lie,
> There with the loved and lost of earth, undestined more to sever,
> In their glad presence shall he dwell, in blessedness forever.

THORACIC DISEASES.

Any classification of the diseases to which the human body is subject must necessarily be, to an extent, artificial and imperfect. Both advantages and disadvantages attend every arrangement which ever has been, or ever can be adopted. In what I may say in this volume, and in others which I intend (*Deo volente*) to succeed it, I shall employ, in the main, a topographical division.

As the subject of this volume I have selected THE VARIOUS DISEASES BELONGING TO THE CAVITY OF THE THORAX; but, passing down the cervix to exclude *cervical* diseases, where shall I begin my reckoning of *thoracic?* It best suits my convenience to commence at the bifurcation of the trachea, that is, at the origin of the right and left primary bronchi. I pause upon that separating muscle, the diaphragm.

Having, however, bounded the field of my observation, I find myself at a loss in examining the objects within. Some of the diseases here observed are of such a nature as to exist only in this locality: others imply an affection common to the thorax and other parts of the body; while others still are only local manifestations of a morbid influence pervading the whole system. In my classification, I shall embrace all those affections which are quite prominently exhibited in the thoracic cavity.

PART I.

GENERAL CONSIDERATIONS.

Before proceeding to a particular description of the several diseases appertaining to the thorax, various abstract principles and preliminary matters require some illustration. On such topics as are but remotely connected with these diseases, or are readily understood, the medical reader must be left to inform himself from other sources; and the following pages take it for granted, that, as far as these topics have a bearing on the primary subject of this work, the labor of proper investigation has already been performed. Other topics, however, of the first importance, are of such a nature as to demand here a somewhat full discussion.

DIVISION I.

PATHOLOGY.

Pathology treats of whatever relates to the physical system in a state of disease. In its most limited application, it implies a description of altered structures or morbid conditions. In a more enlarged sense, however, it involves, besides this consideration, an explanation of the processes by which the existing condition is produced,—also, of the causes by which those processes have been established, and of the consequences of that condition, or the symptoms occasioned.

My present purpose does not require nor allow an extensive discussion of pathological principles. I limit myself to such matters as are quite intimately connected with diseases of the thorax; but, in illustrating them, I am obliged to dwell a little on some considerations which are in themselves strictly physiological.

CHAPTER I.

FEVER.

The term *fever*, in its original application, as is evident from the import of the corresponding word in Latin and in several modern languages, signifies *heat*. From this sense, however, a wide departure has long since been taken. When the nosological system of classification universally prevailed, the term was used to indicate a certain collection of symptoms, such as an abnornal degree of heat in the body, an accelerated pulse, a furred tongue, and a generally impaired state of the corporeal functions. Inasmuch, however, as very different pathological conditions may produce these symptoms, Cullen, at a somewhat later period, chose the the term *pyrexia* to mark these constitutional disturbances when arising from some local cause; and he limited the former term to the designation of similar symptoms, when the cause is some general and not well understood influence upon the physical system. It would be well now for the interests of medical science, if the profession would favor this distinction. At any rate, to avoid confusion of ideas, it is indispensible to remember, that the term is employed to indicate symptoms which arise from very dissimilar causes.

When the cause is inflammation or any local disturbance, whatever, I call the constitutional excitement *symptomatic fever*, or *pyrexia*. On the contrary, when the cause is the existence of morbific matter in the current of the circulation (,whether this has been introduced from the atmosphere without, or by means of mal-assimilation within the system), I designate the disturbance as *idiopathic fever*, or *fever* more properly so called.

In the former case, that of *pyrexia*, the term employed is necessarily applied to the *manifestations* of disease; and, when the cause is purely imflammation of some part, the constitutional manifestations of that cause are sometimes characterized as *inflammatory fever*,—the phrase being used in a sense somewhat more limited than that of *symptomatic fever*. In the sense of *idiopathic*

fever, the term should be understood to involve more immediately certain *pathological conditions* as giving rise to that constitutional excitement which manifests those conditions.

If this distinction should be rigidly observed, the term fever would distinctly characterize a class of diseases, pathologically considered; and all controversy, in regard to the recuperative efforts of nature as constituting fever, would be forever at an end. In this sense, however, the term embraces an extensive and important subject,—one which, though concerned, to some extent, with thoracic diseases, yet more appropriately belongs elsewhere, and which I design to discuss at length in another volume. In the sense of symptomatic fever or pyrexia, as the subject only involves directly the manifestations of existing local disease, it does not require any separate discussion.

CHAPTER II.

INFLAMMATION.

Inflammation is a term derived immediately from *inflammatio*, a Latin word, the root of which is *inflammo, to burn* or *inflame.* It is applied to a local disease, one prominent characteristic of which, is an abnormal degree of heat.

That some things, connected with the nature and manifestations of this disease, are complicated, and have, till of late, been involved in intricacy, I freely admit. In its most prominent features, however, it is exceedingly simple; and one cannot avoid the emotion of wonder, that numerous pages and even volumes have heretofore been written with little effect, except to make gross darkness the more visible. In the theories of medicine, indeed, as in those of theology, much talent has, on different topics, been wasted in dreamy speculations. The more *acute* have been the intellects employed, the more delicately, it is true, *have hairs been split*, but the less has been the amount of practical common sense exhibited. We need not historically come down to the days of Hahnemann, and of sugar globules, represented to possess power in proportion as they approach an infinitesimal division.

Homœopathy may be, indeed, the *quintessence* of professional nonsense; but that which is, at least, *double-refined*, has existed from an earlier period than any portion of the present century.

This lamentable truth has been made more evident on no subject than on that of inflammation. More than one hundred and fifty years since, Boerhaave taught the *luminous doctrine*, that inflammation is caused by viscidity of the blood, and an *error loci* of its particles, together with a morbidly acrimonious state of the fluids. Next come the fanciful and frivolous notions of Stahl and Hoffman respecting the influence of the nervous system in producing inflammation. Passing forward to the middle of the eighteenth century, we find Cullen maintaining the theory, that, in inflammation, there is an obstruction of the blood, produced by "spasm of the extreme arteries, supporting an increased action in the course of them." Hunter, who was nearly contemporary with Cullen, supposed, that, when inflammation exists, there is "a distracted state of parts, which requires another mode of action to restore them to a state of health." This other and necessary mode he considered inflammation to be. Of course, in his opinion, it was a *recuperative* and not a *morbid* process.

Of late years, considerable controversy has been raised, by two conflicting and almost opposite opinions on this subject. One of these opinions makes inflammation depend on "increased action of the capillaries of the part;" the other, on "weakened action of the same vessels, and increased action of the trunks." In support of the one or the other of these opinions, English physicians, no less distinguished than Dr. Thomson, Sir Everard Home, Dr. Wilson Philip, and others of equal professional rank, have adduced their own experiments on living animals; but these experiments, though convincing to their authors, do not, as they are now viewed, establish either of the opposing theories.

Dr. George Hayward of Boston, late "Professor of the Principles of Surgery and Clinical Surgery," in the Medical Department of Harvard University, has been accustomed, in his Medical Lectures, to define inflammation to be "a diseased action of the capillary vessels, attended by redness, swelling, pain, and heat." In this definition, the Professor has certainly manifested talent, lying in one direction. In other words, he has shown ability to

speak with such vagueness, that, while he seems to utter an important sentiment, he really says nothing definite or of moment. Except those who embrace that absurd Hunterian notion, that inflammation is a process of recovery or increased physiological action, none, of course, can doubt, that, in it, there is an abnormal condition of the capillaries, and that redness, swelling, pain, and heat are phenomena attending the local disturbance; but What is the disease of the capillaries? and What is the proximate cause of those phenomena? These, and like questions, the only ones of importance in the case, are left wholly untouched. Besides, the same high authority has uniformly taught the medical students of the University, that, in the healing of a wounded part, the first recuperative process established is inflammation, and that, without this, neither an adhesion nor healthy granulations can be formed. In other words, the language, if I understand it, says, that, where, from any cause, there is a solution of continuity in any of the tissues, the first part of the *curative* process is a particular *morbid* action. So much for medical philosophy and consistency!

Having thus remarked upon the absurdities of those medical opinions which have, at different times, been entertained for nearly two centuries past, and having done this to show what inflammation *is not*, it becomes me now to attempt an illustration of what *it is*. I, therefore, immediately define inflammation to be a state in which the capillaries of the part affected are interrupted in their proper function, are morbidly relaxed, and are over-distended; and, in which the blood that is passing through them is first abnormally excited and chemically changed, and then stagnates and coagulates. This definition supposes a pathological and not a mere symptomatic view of the disease. Its symptomatology would merely say, that it consists in redness, swelling, pain, and heat, as these are the phenomena immediately attending it.

Here I would remark, that the nosological classification of diseases, formerly adopted by the profession, contemplated them, almost exclusively, as different groups of symptoms. The symptoms at any time existing, collectively considered, were called the disease. The causes of these symptoms were divided into proximate and remote. The proximate were what we now call the

disease itself,—that is, the pathological condition giving rise to the symptoms. The remote causes were sub-divided into exciting and predisposing. The exciting were those which, by their immediate action, developed the pathological symptoms. The predisposing were all such influences as prepared the system to be affected by the action of immediate agencies.

In illustrating the disease now before me, I propose to consider its *inherent nature*, its *causes*, and its *effects*. In regard to the first of these particulars, I remark, that, when, for any cause, the nerves connected with the contractile fibrous tissue of the capillaries lose their power, the tension of the coats of the vessels is not preserved, and, as the consequence, the relaxation is immediately manifested by those vessels' becoming abnormally filled. This, I suppose, to be the usual way in which capillary congestion is effected. The relaxation is primary, and the over-distention secondary. The process may, however, and sometimes doubtless does, commence in the opposite direction. Arterial excitement, by increasing abnormally the current of the blood, may mechanically force open the capillaries, and the relaxation may occur, secondarily, as the effect of over-distention, in destroying the innervation. The former of these modes Dr. C. J. B. Williams calls that of congestion; the latter, that of determination of the blood. Both causes, may, indeed, exist at the same time. The vessels may morbidly relax and arterial excitement may occur simultaneously.

But, in whichever manner the fulness or congestion of the capillaries takes place, it can seldom be allowed long to remain without producing the characteristics of inflammation. There may, however, for a season, be capillary congestion without inflammation; but there cannot be inflammation without capillary congestion, as a primary part of the process. Capillary congestion is not inflammation, but inflammation is capillary congestion and something more.

In the commencement of inflammation, as the capillary vessels are beginning to be clogged, the onward current of blood is, of course, partially obstructed, and perturbation follows. When the part concerned is microscopically examined, the white globules and the red corpuscles are seen passing, for a time, in different directions,—onward, backward, and obliquely. Soon the white

globules, which pass not so centrally in the current as the red corpuscles, begin to adhere to the walls of the capillaries. As the disease advances, the relaxed vessels having become distended to their utmost, by the stagnated blood, doubtless sometimes suffer a portion of it to be effused or extravasated into the circumjacent areolar tissue. When this takes place, that which has left the vessels soon coagulates and becomes foreign matter. Indeed, its coagulation is the same as that of blood drawn into a cup, in ordinary venesection.

But the blood within the vessels is the only portion of special importance to be considered; and this is the subject of very peculiar and interesting changes, worthy of a more minute description. The functions of secretion and nutrition, in connection with the part affected, being partially or wholly arrested, it would seem, that the nervo-vital power usually employed in those functions, is not supplied, or passes in another direction; and the electricity, set free by the union of carbonic or proteine matter in the capillaries with the oxygen contained in the red corpuscles is expended within the current itself.

In this process, the fibrine is immediately increased. Probably this is due to an arrest of secretion and nutrition, not merely in the part inflamed, but, to an extent, sympathetically throughout the system. That there is such a general arrest is evident from the symptomatic fever or constitutional disturbance which takes place.

The white or lymph globules, too, are soon found in an abnormal quantity. Chemically, these globules consist of the deutoxide of proteine. Their organization, however, seems to involve a degree of vitality. They are spheroidal bodies of gelatinous consistency; and, indeed, have clearly the characteristics of large and crudely formed cells. At any rate, they are made up of granules in such a way as, in their more perfect state, if not in every instance, to possess nuclei and cell walls. They have a strong disposition to adhere to one another and to the walls of the capillaries.

Hitherto physiologists have supposed these globules to be the red or blood corpuscles in a forming condition. In my judgment, however, they are entirely distinct, are formed in a different way,

and for very different purposes. The red corpuscles are much larger than the white globules,—are different in form and in structure. The former are discoid in shape and have no nuclei. Besides a proteine compound, they contain iron and the various incidental and stimulating elements of the blood; and their special office seems to be to convey oxygen from the atmosphere to the capillaries, to create animal heat, set electricity free, and, by a stimulating effect, give rise to vital action. They have their origin in the blood-vessels, and, in these vessels, serve their purposes, and perish.

The white globules, on the contrary, are evidently formed from liquid fibrine, by the oxidizing process which makes a solid deutoxide. Fibrinization, we know, commences at the lacteals, and increases throughout the course of the lymphatics, till the current of united lymph and chyle is passed into the venous system, at the terminus of the thoracic duct. Fibrine is polarized or partially organized albumen. To my own mind, there seems good reason for the belief, that the elementary granules of vital being have their origin in the lymphatic glands, and pass with and as a part of the fibrine, into the current of the blood; so that fibrine, not merely is *chemically* organized, but has the first traces of *vital* organization. If a portion of chyle or any nutritious matter enters the blood, as it would seem that it does, by venous absorption, and without passing through the lymphatic system, this may aid in the chemical formation of the red corpuscles, or it may be vitalized, by the power of the elementary granules, while in the blood vessels.

Be the truth, however, in regard to these latter speculations, as it may, it is now certain, that, in inflammation, white globules exist, in abnormal amount, in the capillaries of the part affected, and *they are actually formed in those capillaries.* It is, also, certain, that these globules adhere to one another and to the walls of the affected vessels, thereby producing partial or entire stagnation of the blood. During the process of the chemical change, the circulation of the blood is disturbed and the motion of its particles is quickened. As soon, however, as the vessels are fully obstructed, the current necessarily ceases, and the blood coagulates. When this takes place in some of the capillaries, the sur-

rounding ones receive the current by the anastomosing vessels, and, of course, are subjected, for the time, to an increased circulation; but, in their turn, they are liable to be obstructed, and become the recipients of stagnant and coagulated blood.

This disposition of the white globules to adhere to the walls of the capillaries has been ascribed to the existence of vital attraction; but, probably, it is only the result of that physical property of adhesiveness which belongs generally to soft solids composed of glutinous materials. At any rate, whatever may be the immediate cause of the adhesion, the effect is, at length, to arrest all vital action in the part, and produce coagulation.

As for the red corpuscles, during the process of obstruction, they remain for a season free, passing tortuously in the midst of surrounding white globules. At length, however, they have no longer space to move, and are so crowded into the interstices of the white globules, that the whole vessels concerned contain a large accumulation of them. The liquid fibrine and serum pass on, or are literally *filtered out.*

The CAUSES of inflammation may be divided into *predisposing* and *exciting.* The *predisposing* are the influences which prepare the system, or some particular part of it, to take on inflammatory action. They are exceedingly various, and their specification, in this connexion, is entirely unnecessary.

The *exciting causes* demand a hasty consideration here. They are mainly contusion, friction, heat, cold, venous compression, and the absorption, into the blood, of morbific matter.

Contusion becomes a cause of inflammation by an exhaustion of nervous energy, or a destruction of nervous fibres, and an interference with their action; so that the vessels readily assume a morbidly relaxed and over-distended condition. In this condition there may be effusion; or the cause may even rupture a portion of the vessels, and afford unnatural outlets to the blood. This is called extravasation; and it often attends inflammation, when resulting from the cause now under consideration.

The operation of *friction* is similar to that of contusion. The nervous energy is exhausted or the nervous fibres are impaired, and the capillary vessels are weakened, so as to prevent their proper action in passing the blood along to the veins. The

effect, of course, is congestion; and, if long continued, inflammation.

Excessive *heat*, applied to a part, produces inflammation there, much after the manner of contusion and friction, by overcoming the nervous energy and impairing the action of the capillaries. Local inflammation, in a remote part, however, may be produced by such an application of heat as affects the constitution generally and creates arterial excitement. The balance between the flow of blood into the capillaries and that from them being destroyed, over-distention and morbid relaxation, with the various characteristics of inflammation, follow.

Cold, philosophically considered, is a mere negation—the absence of heat; but, in common language, when the temperature of the atmosphere is moderate and becoming less, we speak of an increase of cold. Using the term, thus, in the popular sense, I speak of the effect of an excessive local application of cold as impairing the nervous energies of the capillaries, and, as in the preceeding instances, giving rise to supervening inflammation. Cold, so applied as to act constitutionally, may inflame a remote part, by destroying, as in the case of excessive heat, the balance of the circulation.

The immediate effect of *the compression of a vein* is congestion of that vessel, in the part through which the blood is approaching the point of compression; and, if the congestion is continued for any length of time, an effusion of serum into the circumjacent areolar tissue ordinarily follows. Sometimes, however, the compression, and, more especially, the obliteration of a vein, extending a congested condition back to the capillaries, and disturbing vital action, gives rise to inflammation.

But the most fruitful and important source of inflammation, is *a depraved condition of the blood.* The absorption of morbific matter, of almost any kind, so renders the circulating fluid an unhealthy stimulus to the nerves, that inflammation supervenes, as the consequence. It would seem, that, owing to some chemical or other affinity, on the part of different ingredients in the blood, for different tissues or organs, the localities of the inflammation created are varied according to the nature of the causes. In general, however, it will be found, that, when local inflammations

take place as the effect of an abnormal condition of the blood, that blood is too rich in fibrine absolutely, or, at any rate, in proportion to the amount of corpuscles. Thus, while inflammation uniformly gives rise to an increase of fibrine, a quantity abnormally great, already existing in the blood, favors the local development of inflammation.

The fibrine, in connexion with the primary granules which accompany, and perhaps elaborate it, is that part of the blood which supplies the natural waste of the tissues, and repairs those tissues, when wounded. The red corpuscles, on the contrary, supply the nervous ganglia with electricity, or the material necessary for those ganglia to employ, in creating nervo-vital fluid.

The fibrine evidently affords the base for the formation of that deutoxide compound called the white globules. These globules, therefore, though in part, perhaps, a chemical combination, are yet in part, at least, vitally organized,—the vital power, it would seem, being supplied by the products of the lymphatic glands. The red corpuscles, on the other hand, being too abundant, in any case, in proportion to the fibrine, we seldom have inflammation in any part, but the patient is liable to congestion of the veins, to their rupture, and to a consequent hemorrhage. This liability especially exists in regard to the brain. Hence the frequency of apoplexy with plethoric persons, or those having an excess of red corpuscles in the blood.

The nervo-vital fluid being increased, is adapted, in itself, perhaps, to give additional strength to the arteries. Still, in inflammation, there is arterial fulness; and this is evidently produced directly by the capillary obstruction checking the onward current, or by the constitutional excitement increasing the arterial circulation. The exciting effect of the corpuscles, on the contrary, is, like the external irritation of the atmosphere, a mere chemical and not a vital influence, and is, therefore, in undue proportion, debilitating and not strengthening. The fibrine and primary granules, when not abundant, being *used up*, to a considerable extent, at the capillaries, the red corpuscles, especially if forming too large a proportion of the blood, afford an abnormal irritation to the veins, weakening their energy, and causing their over-distention.

Among the EFFECTS of inflammation I rank, in the first place, the

various phenomena by which it has been nosologically characterized.

The *redness* is owing to an increased amount of blood in the congested vessels, with what is sometimes around them. The different shades of the redness result, partly, from the different proportions in the amount of arterial and venous blood in the capillaries, and, partly, from the different conditions of the same kind of blood. Ordinarily the color is somewhat scarlet, because it is mainly arterial blood which fills the capillaries. This is especially true in scarlatina, rubeola, and other eruptive diseases. In the active form of superficial erysipelas, we have a similar condition. Indeed, much that is ordinarily called erysipelatous inflammation, is rather erysipelatous congestion,—the blood remaining in the relaxed capillaries, and not being coagulated, nor having undergone the chemical changes characteristic of inflammation. In this condition, the color of the part effected is a bright scarlet; but, as the congestion passes into inflammation proper, the color becomes essentially that of ordinary inflammation. After considerable exposure to violent cold, the part becomes congested, and the color is then purplish. This is because the venous portion of the vascular system, lying more superficial than the arterial, the blood in the former is so stagnated as to crowd into the capillaries and give the darkened shade. Of course, if inflammation proper becomes established, the same characteristeric measurably remains. In general, while the inflammation is in its active state and there is considerable constitutional excitement, the hue is florid; but, after the blood has been, for some time, stagnant, the color becomes deeper. The presence of the white globules, however, tends to render the tinge lighter, than is the usual tinge of simple congestion. In all cases, when the blood has been coagulated for a considerable time, the color becomes darker, in consequence of the change in the coagulated material.

The *swelling* of inflammation is the result of the accumulation of blood in the part affected; and it is proportioned to the abnormal amount detained in and sometimes around the capillary vessels. Of course, the increase of the part is essentially the same before and after the blood has coagulated. In connection with the enlargement by inflammation, there may be and often is a farther en-

largement by other means, as by œdema, by a congestion of the lymphatic vessels, or by a collection of pus; but, in general, these different effects are easily discriminated. Different tissues, it is true, are capable of very different degrees of swelling by inflammation; but this is due to the difference in the vascularity of their structure and in their capacity to receive blood. Mucous tissues, for instance, are more vascular than serous, and are, consequently, capable of more accumulation of blood. The same is true of the cutaneous tissue. Hence the very appreciable amount of swelling shown in the skin, in different eruptive diseases, modified, however by some of the other circumstances already referred to. But to the muscular, the areolar, and the glandular tissues, from the character of their structure, we are more especially to look for the greatest amount of enlargement, when the part is inflamed. In these the swelling is, sometimes, not only considerable, but very great.

The *pain* of inflammation is produced, partly, by the tension of the tissues or the pressure made on the nerves of the part affected; and, partly, perhaps, by an exaltation of the sensibility created by the temporary arterial excitement, or determination of blood. It is different in different portions of the system, being varied by the degree of innervation and other circumstances, under the influence of the same immediate cause. Let the natural sensibility of the part be acute, the arterial excitement considerable, and the pressure strong;—we then have the severest pain, as in inflammation of the sheath of a nerve, the pulp of a tooth, &c. Indeed, when the natural sensibility is not great, the other circumstances combined may give distressing pain; as, for instance, when the lining of an osseous canal is inflamed. The strong determination of blood to the part and its confinement by pressure may so exalt the sensibility, though in health it is not great, as to render the pain most excruciating.

The inflammation may be so located and the tissues concerned may be of such a character, that but little or no pain is experienced, except when the part is pressed, or its tissues are somehow put upon the stretch. This condition, which is called *tenderness*, exists commonly in enteritis, sometimes in pleuritis, and indeed in various affections. There are, under peculiar circumstances, other

modifications of pain which are commonly called feelings of soreness, of smarting, of tingling, of heat, &c.; but which need no special illustration here. They are the pain of inflammation, united with sensations produced by connected causes.

The *heat* of inflammation presents a problem which, till of late, has not been well solved. Animal heat is maintained by a process of combustion or oxidation. In the lungs, in the act of inspiration, a portion of the blood is evidently oxidized, by the oxygen inspired, and caloric is evolved; so that arterial blood proceeding from the lungs is one or two degrees warmer than the venous which enters them. A part, too, of the inspired oxygen is taken up, "and is carried, by the agency of" the red corpuscles, or "a compound of iron, to every part of the body." In the capillaries, oxidation again takes place, by a union of oxygen with either effete portions of tissue, or those portions of the circulation which are not in a condition to be appropriated to nutrition, properly so called. The adipose tissue of the animal body, we know, is only the non-azotized elements of the food (,or such as will not form the other tissues and nourish the system), organized (,when the oxygen present is not sufficient for their immediate combustion), and deposited, to be used for oxidation, when afterwards needed; and, "in the herbivoræ, a great part of the combustion which yields the animal heat is carried on at the expense of those parts of the food which cannot form blood; namely, sugar, starch, or gum, fat, &c." Besides the oxygen which enters the circulation through the lungs, a considerable quantity is, also, received into the system by absorption, through the skin, and mucous tissues; and this is, in like manner, used for the oxidizing process. The immediate result of this process is the formation of carbonic acid and water, which are disposed of mainly by the lungs and by the tegumentary tissue. The effect of active exercise is to quicken the respiration, and the circulation,—thereby impelling more blood and carrying more oxygen into the capillaries of the surface, as well as elsewhere. The result of this is increased oxidation, it is true; but a portion of the acid and the water, formed by the invigorated action of the perspiring follicles, passes upon the surface, in the form of perspired matter.

The evaporation of this matter, in obedience to a well known chemical law, promotes coolness at the perspiring part.

Now, in inflammation, the perspiring follicles are not invigorated by an increased power of the nervous tissue. On the contrary, that power is weakened or destroyed, the perspiration is checked or prevented, and the cooling effect is diminished or lost. At the same time, the oxidizing process is not diminished but is increased. It does not appear, that the matter of the tissues becomes more rapidly effete. On the contrary, it would even seem, that, to an extent, the process is, with that of nutrition, suspended. But, while the nervous power is not used in the ordinary secretions and excretions by which the system is nourished and changed, that same power is evidently diverted from the nutritive to the excito-motory branch of the nervous system. Hence arises the constitutional excitement, which always, to an extent, attends inflammation. The respiration and the circulation are quickened; the materials for an increased oxidation in the capillaries of the inflamed part are supplied; and, through the local irritation, an unusual process of oxidation, within the capillaries, is set up. It is that already described, in which the white globules are abnormally multiplied. This process, from the nature of chemical laws, must evolve heat; and I suppose it to be the principal source of the increased heat of inflammation.

The fact, that, under constitional excitement, the blood, heated at the lungs, passes more rapidly to the inflamed part, has, doubtless, a slight influence in creating the local heat; but that the cause is principally local, is evident from the simple consideration, that, occasionally, the affected portion has a temperature of 102, 104, and even 106, or more degrees of Fahrenheit.

In explaining the phenomena by which inflammation reveals itself, other effects have already been referred to. One of these is *the interruption of the functions of secretion and nutrition.* In health, the fibrine, with the primary granules, is constantly being applied to the regeneration of the tissues, as the matter of those tissues is constantly losing its vitality and becoming effete. But, in inflammation, it has been already said, the interruption of the nervous action suspends this process, in the inflamed part; and it

would seem, that, by sympathy, it is, also, in a great degree, suspended throughout the system.

Hence, another consequence is, that *fibrine accumulates* in the blood,—increasing, from less than three parts in a thousand, not unfrequently to five, and, sometimes, even to seven or eight.

I ascribe to this cause the increase of fibrine characteristic of inflammation, rather than to any peculiar cause existing exclusively in the part affected. That the white globules are elaborated mainly in the part affected is evident; but their elaboration is an oxidation of existing fibrine, which is a vitalized compound. The increase of fibrine is proportioned to the extent and duration of the inflammation, in the active state; but so, also, are the constitutional disturbance and the suspension of the secreting and nutritive processes. That the blood in the inflamed part contains more fibrine than in others, may be true; but, if so, as the ordinary vital processes are more interrupted there than elsewhere, this may afford an explanation of the cause.

Again, the effect of the suspension of the nutritive function is, that there is *no sense of want* in the system,—in other words, *no appetite;* and the taking of food, under the circumstances, only imposes a burden upon the powers of nature.

Here I may remark, in passing, that, if the process by which effete matter is thrown off, is a vital act, and governed by laws similar to those by which a new deposit is made, then it must cease, substantially, when the other process is suspended. If, on the other hand, it is a mere chemical process,—such as attends all decay of animal matter,—then it will not be effected by the condition of the vital functions. Some facts, it seems to me, strongly commend the former view; and, among these, the comparatively slight diminution of the azotized tissues, when, by reason of constitutional disturbance, the appetite is destroyed, and little or no food is taken for a considerable length of time. In that condition, it is true, the adipose tissue is used up in creating animal heat; but it is the consumption of that tissue, mainly, which produces any occurring emaciation.

I have already alluded to the suspension of superficial perspiration as an effect of inflammation. This needs no farther illustration than to say, that the matter seems to be governed by a law

in common with that which controls the replenishing and the detrition of the tissues.

There are other effects of inflammation; but, being more remote and constitutional, they do not require discussion here.

CHAPTER III.

CONGESTION.

I have spoken of inflammation as commencing in a congestion of the capillaries. When, however, we speak of congestion, as a disease, we mean an excessive fulness of the larger vessels, and commonly the veins. From the veins, when lying superficially, in connexion with mucous tissues, there seems sometimes to be *an effusion* of blood as a whole, or a hemorrhage, without any apparent lesion of the vessels. This is illustrated in ordinary cases of hematemesis, and in some cases of hemoptysis. It may, however, be reasonably questioned, whether, in these cases, there is not an actual rupture of the delicate coats of the smaller veins.

Be that as it may, ordinarily at least, when blood *leaks* from the veins, it is because of *a rupture* of their coats; that is, it is hemorrhage by extravasation. This rupture, of course, is the effect of pressure and over-distention. But it is veins, and not capillaries, that are the subject of lesion; and the constitutional effects of the hemorrhage are very different from those of inflammation. When the hemorrhage is produced upon the brain, the result is apoplexy, and not brain fever;—when produced in the lungs, it is the disease, pulmonary hemorrhage or pulmonary apoplexy, and not pneumonitis. In short, whatever disturbance it may produce in the system, it does not give rise to such an amount of constitutional excitement or symptomatic fever, as inflammation. Inflammation is liable to be caused by an abnormal increase of fibrine. Hemorrhage often results from an excess of red corpuscles; or it may be produced by a weakness of the vessels, or by an obstruction; but it always has congestion as its immediate antecedent.

Congestion is divided into *active* and *passive*, or, as some prefer, into *active*, *passive*, and *mechanical*.

Suppose, then, that the *vis a tergo* (,whether consisting in the heated and expanded condition of the blood in the lungs, or in the action of the heart), or suppose, that some abnormal irritation of the arterial muscular coat, or various influences combined, are hastening the current through the arteries, while, from the capillaries onward through the veins, it is not hastened, the invariable effect must be congestion. This is *sthenic* or *active congestion*.

Again, suppose the veins to be weakened, and the circulation through them to be consequently checked,—the current from the heart coming on with its normal rapidity,—then, of course, congestion must follow as before. This is *asthenic* or *passive congestion*.

I am of the opinion that a weakened condition of the muscular coat of the veins, together with a weakness in the power of the valves, is not unfrequently the principal cause of congestion. The veins not having tonicity enough to support the current, are morbidly relaxed; and, the valves not affording the proper resistance, the power of gravitation, when the position of the patient favors, occasions congestion.

Still, again, suppose the blood to be impeded, in its return to the heart, by some obstruction in the course of the veins, so that it accumulates in a portion of the venous system. This is what Dr. Watson calls *mechanical congestion;* but it may, with equal propriety, be called *passive congestion*. It is the result, not of increased, but of obstructed and diminished action. We have an instance of it, in the case of cording the arm for venesection. The veins, lying nearer the surface than the arteries, are mechanically obstructed, and the blood accumulates.

CHAPTER IV.

SEROUS EFFUSION.

There are two methods under which the serum of the blood is separated from the other portions, and is collected either in areolar tissue or in shut sack. The one of these methods which I

call secretion, will be considered in another connexion. The other which is effusion, requires to be illustrated here. The former supposes an active condition of secreting organs. The latter implies merely a passive, or relaxed and over-distended state of the coats of the larger vessels,—ordinarily, if not always, the veins.

Compress any of the veins, as when a ligature is applied to the arm preparatory to venesection, and let the compression remain for a considerable time ;—œdema of the surrounding areolar tissue will invariably take place. That is, the serum of the blood will be effused or passed through the coats of the veins. The fibrine and the red corpuscles being vitally and chemically organized, of course, their proximate elements occupy an appreciable space; whereas the serum, being without any distinct traces of organization, is made up of elements in a different condition. These elements will readily pass through interstices too small to allow the passage of the fibrine or of the red corpuscles. In all cases, in which the course of the blood in the veins is materially obstructed, for any length of time, the consequence is a serous effusion. Hence, according to the position of the obstruction, arise different forms of dropsy.

It has been supposed, that capillary obstruction, holding back the arterial current and causing over-distention in the arteries, sometimes, produces effusion through the arterial coats. In regard to the systemic circulation, I think this is not so. Certain I am, that in general, serous effusion takes place from the venous, and not from the arterial system; and it would seem to be owing to the fact, that venous blood contains a less proportion of fibrine than arterial, and, consequently, has a less amount of vitality.

Two considerations favor this supposition. The first is this. The circumstances of the lungs are peculiar. The pulmonary arteries circulate the purple or venous blood; and, when, in pneumonitis, there is an obstruction of the capillaries by the inflammation, besides the blood effused at the capillaries, there is, also, a degree of serous effusion. It would seem, that this takes place, through the pulmonary arteries, from the blood which has not yet acquired the arterial character, and that it is owing to the diminished amount of vitality in the purple blood.

The other consideration is the effect of repeated acts of venesection, or of hemorrhage from an accidental cause. As the blood loses its proportion, not merely of red corpuscles, but finally of fibrine, and becomes more serous, a dropsical effusion sets in and increases.

CHAPTER V.

THE REPARATIVE PROCESS.

Those who embrace the notions of Hunter, that inflammation is a recuperative, and not a morbid action, seem to confound together two processes, which are almost as unlike each other, as the hardening of clay by the presence of heat, and the hardening of water by the diminution of heat. Not only, indeed, are the two processes very dissimilar, but any considerable amount of inflammation, in any wound, will, at any time, utterly prevent the process of reparation. It is probable, however, that the frequently close succession of the one process to the other has aided in betraying pathologists into an important error in regard to the nature of inflammation, and in giving rise to such language as "wounds uniting by adhesive inflammation,"—"granulations formed under the influence of a healthy inflammation,"—and the like.

The truth is, the reparative process is entirely distinct from that of inflammation, and, in almost every particular, unlike it. In the former, there is nothing of the redness, swelling, pain, or heat which characterize inflammation. There is not, to any extent, a morbidly relaxed and over-distended condition of the capillary vessels; nor is there an effusion or extravasation of blood into the circumjacent tissue, as sometimes occurs in inflammation. Indeed, the two processes have scarcely a single phenomenon in common.

The reparative process, taking place after a lesion has, by any means, been produced, is but little more than an increased and slightly modified condition of that action by which the system is being constantly repaired,—i. e., by which the place of effete matter removed is supplied. The lesion may be the result of an

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incision, of contusion, of inflammation itself, or of some one of various other means; but the process of cure is substantially the same, in all cases.

This process of repair is not under the control of any independent power, that is properly entitled to some distinctive name, such as *vis medicatrix naturæ*, *vires vitæ*, or *the recuperative power of nature*. The process is simply one controlled by law, established in the system and at all times existing. The results, of course, differ, according to the existence of different conditions, —the law remaining the same. Under the circumstances of ordinary decay, the function of nutrition is performed at such a rate as just to meet the demands of the waste. When that same function needs to be executed more rapidly, the circumstances are such that more nervous stimulus is afforded; but it is all in obedience to an unchanged law. The lesion, through the afferent nerves of the nutritive branch of the nervous system, impressing its condition upon the nervous centres of that branch, the increased exciting influence returns through the efferent nerves of the same branch, and more rapid nutrition is the necessary effect.

It is by this reparative process, that the parts of a wound, being brought together, unite, if under favorable circumstances, by what is called adhesion, or union by the first intention; if, under other circumstances, generally by the formation and appropriation of interstitial matter. Dr. Carpenter, however, considers the process to take place in three different modes; and, evidently, there is, occasionally, a modification of manner, slightly different from the two now named. I cannot, however, wholly endorse the views of Dr. C. According to him, the three modes are as follows.

The first is "the adhesion of the sides of a wound by a medium of coagulable lymph, or of a clot of blood." The second is "reparation without any medium of lymph or granulations,—the cavity of the wound being filled by a natural process of growth from its walls." The third is "reparation by means of a new, vascular, and organized substance, termed granulations."

By the first of these modes is meant to be designated what "is ordinarily termed union by the first intention." But, in this modification of process, no "clot of blood" performs any vital part. Blood, when clotted, becomes dead animal matter, and can never

be again applied to vital purposes. This is just as true, when the blood remains in the tissues and in the capillaries, as when drawn into a vessel. If, by coagulable lymph, however, is meant the *hyaline fluid*, then the expression contains the truth. This fluid is employed in forming cells and producing the adhesion of the sides of the wound; but the term is a bad one, as it suggests the notion of coagulated blood or a clot; and, indeed, seems to have been used, by Dr. C., as synonymous with the phrase, "a clot of blood."

The process of union by the first intention is really a simple one. In the first place, liquor sanguinis is secreted (,not effused), on the edges of the wound,—those edges being placed in juxtaposition. This fluid and the red corpuscles compose the blood; but the red corpuscles remain in the circulating current. That portion of this fluid which is scarcely vitalized, is composed mainly of albumen and water, and is called the serum. The more watery part of this is evaporated or absorbed. The other probably remains; and, with the fibrine (,containing the primary granules), takes on a smooth and glassy appearance. Hence, the whole is called the *hyaline* fluid. It is, also, termed *blastema* and *cytoblastema;* because it is "the basis of every forming structure of the human body;"—in other words, because it contains the first buddings or cell-buddings of new growths. When this fluid is examined by the microscope, it is seen to contain regular, though minute, spheroidal cells; besides which, there are innumerable graniform bodies of still smaller size, appearing merely as specks or dots in the blastema, and these latter are elementary or primary granules,—the very beginnings of the spheroidal cells. These appearances, the fully developed cells, especially, have sometimes been called exudation corpuscles. The name, however, is an unfortunate one, as they are entirely distinct from the red corpuscles, and must not be confounded with the latter.

Though the hyaline fluid is itself *vitally organized*, in a degree, yet it is only the granules and the formations from them, which exhibit the traces of *full or perfect organization*. Every fully developed cell has a triple organization,—a nucleolus or nucleoli (,for there are sometimes two or three within one cell), a

nucleus, and a cell-wall or investing envelope. These nucleoli are really an aggregation of the primary granules.

As the reparative process advances, these nucleoli multiply, and the blastema assumes a greater opacity. Molecules aggregate around one or more of these nucleoli, and a nucleus is formed. To complete the cell, however, a transparent and most delicate membrane, composed of proteine, invests the whole, and constitutes *the wall.* The blastema, in which the cells float is albuminous matter, with only the faintest traces of organization, while the fluid contents of the cell—the medium interposed between the nucleus and the cell-wall—are more distinctly fibrinized—being attracted within, and, in the process, becoming changed, by the vital power of the nucleus.

The nuclei, becoming the parents of other cells, are sometimes called *cytoblasts* or *cell-germs*,—the name being designed to indicate the peculiar function. A nucleus, with its nucleolus or nucleoli, being an aggregation of granules, each one of which is capable of being developed into an independent cell, new cells may be completely formed within a primitive one; or the primitive one may rupture and scatter its contents into the surrounding blastema, where they, in turn, may assume the characteristic triple organization,—producing and reproducing new cells, indefinitely. Again, cells may form, in the blastema, in an isolated manner from pre-existing granules, when these granules are in contact with living tissues. In this case, each granule attracts to itself, assimilates, and organizes a portion of the nutritious fluid, forming it into the cell-wall and the contents of the cell.

Cells, as first found, are generally spheroidal in shape; but they become variously modified, in forming the several different tissues. Sometimes they become elongated, sometimes flattened, fusiform, prismatic, polyhedral, or caudate, according to the purpose to which they are devoted. In the formation of new tissue, the cells arrange themselves in longitudinal lines, the proximate surfaces of the cell-walls disappear, and a tubular cavity is made. In this way, according to the form which the cells assume, and the matter with which they become filled, the muscular, the nervous, the osseous, and all the various tissues are formed.

There are other modifications of circumstances under which

cells appear. Some float in the blastema, independently of each other; and, hence, are called *isolated* cells. From their ephemeral nature, also, they are called *transition* cells, in opposition to those which form an integral part of the more permanent tissues, and are, therefore, called *permanent* cells. The transition cells have their own purposes to serve. For instance, they are employed in the formation of the epidermis, the nails, the epithelial mucous membrane, and, in general, those tissues which are rapidly thrown off and formed anew. Those of the epidermis and the epithelium seem to originate in molecular granules, which are diffused through the substance of the basement membrane.

While cells are developed under such varieties of circumstances as have now been considered, it is, to my own mind, sufficiently clear, that elementary granules exist in the current which circulates in the lymphatic system, and which is composed of lymph and chyle united; and these elementary granules, as well as the more organized portions of cells, are centres or poles, from which emanate nervo-vital influences, to carry on the purposes of vitality and organization.

To return now to the case of an incised wound, suppose new cells, as they are formed, to arrange themselves in order one upon another;—suppose this process to commence on both edges of the wound simultaneously;—and suppose, moreover, that those edges are in juxta-position, that is, are as nearly in contact as they can be conveniently arranged. No sooner does the longitudinal arrangement of cells commence from each edge, than the outermost ones meet, and, by assimilating a portion of the blastema, unite, the circulation becomes established, nervous influences pass from one edge to the other, and the wound is healed. This is the simple process of union by the first intention. A clot of blood, in this case, can do no more than to keep off the atmosphere and other irritating agencies from without, by filling the interstices, where the parts are not entirely in apposition. It is, from this kind of protection, that benefit is secured, by dressing a wound, *in the blood*, as the phrase is. The incised edges, by being immediately shielded from deadening influences, remain in a condition to take on the healing process. Of course, as soon as the

cells, accumulating upon one another, meet from the two edges, the parts unite and the wound is healed.

The SECOND MODE in which Dr. Carpenter considers the reparative process to be effected, Dr. Macartney calls the *modeling process.* In this case, "the surfaces of the wound do not" immediately "unite by vascular connexion." The edges take on a smooth and rather red appearance, much like mucous membrane. They seem also to be slightly moistened with a thin fluid. This is usually considered as a case of natural growth from the walls of the wound, till the parts finally become united. This mode of union may, by care, be effected, where otherwise the process would be accompanied by granulations and suppuration. The means to be employed are the exclusion of air and of other irritating causes.

Now, in my view, the difference between this mode and that of union by the first intention is exceedingly slight. The parts not being in juxta-position, there must be an evident accumulation of cells one upon another. Transition cells form an epithelial covering to the growth from permanent cells; the accumulation continues; and, when the parts meet, the epithelium disappears, and union is effected. The increased accumulation of cells, and the existence of epithelium, during the growth, constitute essentially the whole difference between this mode and that first considered. Indeed, when a wound is said to unite by the first intention, often interstices are first filled by coagulated blood, or are, in some way, protected; and the case is, in part, as really one of the modeling process, as any which are ordinarily regarded as such.

Dr. Carpenter's *third mode* of reparation is one in which granulations are employed. These are formed under the unfavorable circumstances of irritation or continued inflammation. The granulation structure is a special one formed for a temporary purpose. It is endowed with higher vascularity, and a more rapid power of growth, than is possessed by any modification of ordinary tissue; but it is very easily destroyed, by injury or by increased inflammation.

The formation and the effect of the granulation structure prove, that parts, previously healthy, are disposed to heal, in spite of many impediments thrown in their way. Here, however, there is no *vis medicatrix naturæ*, in the sense of an independent power,

interposing, just at this juncture, for the individual's good. An invariable law controls the process, though the nature of that law is not yet fully understood. My own conviction is, that, when granulations are formed, the capillary vessels in connexion with the part affected are always abnormally enlarged, either by irritating causes from without, or by the latter stage of inflammation within. The chemical influence of the atmosphere tends to weaken innervation, and thereby to relax and over-distend the coats of the capillaries. In the passive stage of inflammation, the vessels are yet over-distended, though the counteracting effect of the active period of the disease has essentially subsided. In this case, there is a secretion of liquor sanguinis, but it is modified by the existence of the white globules, or by a chemically changed condition of the blood. Either these globules actually pass through the walls of the over-distended capillaries to form crude cells without; or what is more probable, the primary granules, perhaps, in a modified condition, pass through the vessels, with liquor sanguinis of a modified character; so that the hyaline fluid without differs from what is normal, and from it a different structure is consequently elaborated. In the case of granulations from external irritation, the modification of the hyaline fluid is evidently the result of a change produced either directly on the surface, or at the secreting points of the capillaries. This irritation does not, like inflammation, produce coagulation in the capillaries. Still, it may extend its effect somewhat beneath the surface, so as to form in the vessels, a proteine compound, like that of inflammation.

In the hyaline fluid, as granulations are forming, there are seen extremely minute molecules, composed probably of fatty matter, and granules measuring from one twelve thousandth to one eight thousandth of an inch in diameter, consisting essentially of the deutoxide of proteine with a central molecule of fat; also, still larger bodies, exudation corpuscles, compound granules, or cells, measuring from one six thousandth to one seven hundreth of an inch in diameter. Besides these bodies, there are extremely fine, interlaced, and decussating fibrils much like those seen in the buffy coat of the blood.

The kind of action, then, in the formation of granulations is essentially the same, as that in union by the first intention, or in

the modeling process. Liquor sanguinis, *modified*, is secreted; and, the serum or its watery portion being disposed of, the blastema remains pregnant with cells, which arrange themselves one upon another, presenting the appearance which has been undesirably called that of exudation corpuscles. Over all, an imperfect epithelium is formed, probably by means of transition cells. In this process, as in the more perfect one already described, a portion of the blastema is assimilated and more fully organized. New layers are developed, and the void is, at length, filled.

The effect of any external irritating influences and of any remaining inflammation having passed, the usual reparative process goes forward. In the ordinary nutrition of the system, effete matter is thrown off, as new matter is deposited; and so, in this case, the granulation deposit is separated and absorbed, as the new and more permanent tissue is formed. One peculiarity of appearance, however, remains, after a wound has been permanently healed. The granulation structure, which is removed by interstitial absorption, being less dense than the more permanent tissue, the portions removed, in a given time, occupy more space than those which are deposited. The consequence is, that, after the work is completed, the parts are left contracted and a cicatrix shows itself.

Those fungous growths which are commonly called proud flesh, are the result of an excessive granulating process. That they occur in accordance with fixed law, and under modified nervous action, cannot be questioned, though we cannot trace all the workings of vitality in such exuberant formations.

In every case of lesion, in whatever way created, the healthy condition of the part must be restored by the reparative process, in some one of the modes now considered. If the lesion has been produced by inflammation, and that under ordinary circumstances, as in the muscular and areolar tissues lying near the surface,—and if, at the same time, there is no appreciable destruction of the tissues, the reparative process has comparatively little more to do than it has in serving the ordinary 'purposes of nutrition. When, however, the inflammation is upon a serous tissue, there is frequently a too luxuriant growth, ordinarily termed *false* or *exudation membrane*. In this case, the hyaline fluid is copiously deposited in much the same manner as in superficial fungous growths.

When fungous growths and exudation membranes give place to a normal condition of the parts, the process is evidently that of absorption, just as ordinary granulations are absorbed, when the more permanent structure is formed.

It is proper here to remark, that the plastic power of the blood, that is, its capability of being transformed into organized tissue, is in proportion to the quantity of fibrine which it contains. Though the chyle exhibits faint traces of fibrinization, immediately on passing the lacteals, and though the current of chyle and lymph united partakes more and more of this character, till it reaches the thoracic duct; yet, in the blood, the proportion of fibrine is greater than in any part of the lymphatic current, and that notwithstanding the constant withdrawal of it from the blood for the purposes of nutrition. From this fact it is sufficiently evident, that fibrine is elaborated, *partly*, by some agency in the blood vessels. As to what that agency is I have already given my opinion.

When blood is drawn from the body, and its fibrine is coagulated in a vessel, that coagulated fibrine has something like a rudimentary appearance of organization. It contains what appear much like organic germs. This particular resemblance to the change effected by the conversion of the hyaline fluid into solid tissues, has probably been principally concerned in giving rise to confused notions and uses of terms, in speaking of the reparative process. These organic germs, or corpuscles, as they have been called, which appear in a clot of fibrine, seem to be formed by means of an electric influence derived from the atmosphere. But electricity is not nervo-vital fluid, and, therefore, cannot do the full work of that fluid. It, to some extent, imitates, but it cannot become vital action.

CHAPTER VI.

THE RED CORPUSCLES.

"The *human blood corpuscles* or *red globules*," says Dr. Morton, "are flattened circular discs, with a central concavity or depression on each surface, which, in some respects, gives them an

annular appearance. They vary between the 300th and the 400th of a line in diameter, and their thickness is about one fourth of that measure. Each corpuscle is a cell, of which the envelope is elastic, homogeneous, pellucid, and colorless; and the contents are of a more or less deeply red color. They are, however, destitute of distinct nuclei,—the dark spot which is seen in their centre being merely an effect of refraction, in consequence of the double concave form of the disc. But, since the corpuscles of the lower animals are distinctly nucleated, some physiologists insist, that the nucleus exists also in the blood of mammiferæ, although it has hitherto eluded positive demonstration."

"The vesicular envelopes of the blood discs have been supposed to be analogous in character to fibrine, being extremely delicate, transparent, and highly elastic membranes."

"The contents of the capsule consist of two different substances, called *hæmatine*" or *hæmatocine*, "and *globuline*."

"*Hæmatine* or *hæmatocine* is the compound that fills and forms," with globuline, "the substance of the corpuscle, and gives it its characteristic color. When the coloring matter is separated from the other constituents, it appears as a dark brown substance, insoluble in water, ether, acids, or alkalies, or in alcohol alone, but dissolves in alcohol with the addition of sulphuric acid or ammonia. This solution has also a dark color, and possesses all the properties of the coloring matter of venous blood. It contains a considerable proportion of peroxide of iron; but Scherer has proved, contrary to the received opinion, that the coloring matter is not derived altogether from the iron, because, when the latter is wholly separated from the hæmatine, a deep-red coloring matter still remains."

Kirkes and Paget, however, say of it, that, as ordinarily obtained, "it is soluble in water, by which it may, with the globuline, be washed out of the blood corpuscles; and from this solution it is precipitated, by most metallic salts and by concentrated acids. In the living or recent state of the blood corpuscles, the hæmatine is confined within their cell-walls, and appears to be insoluble in the serum; but, when the blood begins to decompose, and the cell-walls, losing their texture, permit the outward passage of their contents, both the hæmatine and the globuline are dis-

solved in the serum which thus becomes blood-colored, and may impart its tinge to the surrounding parts. In the purest state in which it can be obtained, it is so far changed as to be insoluble in water, of a deep blackish-brown color, and not liable to change of color on exposure to gases. Boiling alcohol will dissolve small quantities of it, and it is freely soluble in alcohol acidulated with sulphuric, hydrochloric, or nitric acid, and in weak solutions of potash, soda, or ammonia."

"The presence of so large a proportion of iron, constitutes a peculiar feature in hæmatine. The mode in which the metal exists in it has been much discussed. By some it is supposed to be in the form of an acid, or a salt, or in the form of peroxide in arterial blood, and carbonate of the protoxide of iron in venous blood. The greater probability is, that the iron is combined, as an element, with the four essential elements, in the same manner as, it is held, sulphur is combined with them in albumen, fibrine, cystic oxide, &c."

"It is very doubtful, whether the rapid change of color, which is effected in respiration and on the contact of various gases, can be referred to any chemical changes whatever, in the hæmatine. Much more probably it is due to changes in the form of the blood corpuscles and their consequently different modes of reflecting and transmitting light. Saline solutions, if denser than the liquor sanguinis, contract and shrivel up the corpuscles, making them deeply bi-concave; and distilled water has the contrary effect, swelling out the corpuscles, and making them thickly bi-convex or spherical. Changes corresponding with these are produced, by the contact of oxygen and of carbonic acid with the corpuscles; —the former contracting them, and making their cell-membranes thick and granular,—the latter dilating them, and thinning and finally dissolving their cell-walls. Herein, then, is a sufficient explanation of the changes that the corpuscles undergo, without supposing any immediate chemical alteration in the hæmatine."

"*Globuline*," says Dr. Morton, "is obtained from the capsule of the red corpuscles and is their component element. It is regarded, by the chemists as a proteine compound, closely allied to albumen, —from which it differs, however, in being soluble in serum and in coagulating in a granular form, unlike the residue from albu-

men. Henlé suggests, that globuline is albumen, modified by combination with the substance of the disc-envelopes. The globuline and hæmatine combined constitute the admitted contents of the globules, and are called the *cruor*."

Kirkes and Paget say, that "globuline appears to be a proteine compound. According to Simon, it bears some resemblance to caseine, on which account he named it caseine of blood; but Liebig and others regard it as more similar to albumen. It is soluble in water, and its solution, when heated, forms a granular coagulum."

What I have now quoted refers to the chemical character of the corpuscles. In regard to their origin, Dr. Morton says, "The human blood corpuscles are, by many physiologists, even by those who deny their nucleated character, regarded as cells, capable of reproduction in the manner of the cells of other tissues." In thus speaking of "other tissues," the doctor seems to regard the blood itself as a tissue. He continues,—"This process, according to the latest microscopists, is shown in the following manner. First, radiating lines are seen to pass from the centre to the periphery, dividing the disc into several segments, usually six in number; and these parts become gradually isolated from the parent corpuscle, and constitute as many new and independent cells. It is, in this manner, that the red corpuscles are rapidly generated by a power of self-production within themselves,—which is increased or retarded, however, by various circumstances."

Thus much, in regard to the nature of the red corpuscles, being understood, the grand but hitherto unsettled question arises, What is their function? Different conjectures have been formed. One is, that they convert the albumen of the blood into fibrine. But, to this view, there are serious objections. Fibrine is extensively found in the lymphatic vessels, and yet these vessels contain no red corpuscles. Again, invertebrate animals have no red globules in their blood; but albumen, with them, is changed into fibrine as readily as with animals having red blood.

Another conjecture is, that the red corpuscles are "carriers of oxygen to the various tissues, and of carbonic acid from these tissues to the lungs." To an extent this is, doubtless, the correct theory. Experiments, it is true, have shown very clearly, that a

portion of the oxygen taken into the lungs, in respiration, is, in those organs, united with carbon which is in the blood, there to form carbonic acid. So far, then, as the oxygen is there used, it cannot be carried through the circulation by the corpuscles; and, so far as carbonic acid is formed in the lungs, it cannot be brought to the lungs, by the corpuscles.

Still, it is certain, that oxidation takes place in the capillaries, throughout the system; and the oxygen employed must be transmitted through the arteries by the red corpuscles, while the carbonic acid created at the capillaries must be returned through the veins, by the same vehicles.

The most directly vital office of the red corpuscles, however, is the reception and transmission of electricity. Whether this is attracted from the inspired air, by the power of the iron contained in them, or is generated in connexion with the oxidizing process, is yet a matter of doubt. Be that as it may, electricity being found in connexion with the corpuscles, they then, through afferent nerves connected with the serous coat of the blood-vessels, convey that electricity to the nervous centres or ganglia of the several nervous systems. At these ganglia, the electric fluid is converted into nervo-vital fluid, and is then sent, by efferent nerves, to every part of the body. Of course, a portion of this nervo-vital fluid, sent from the ganglia of the nutritive system, passes to the lymphatic glands, where the elementary granules of the cells have their origin, there to form these granules,—as well as to the lymphatic ducts generally, to elaborate fibrine from the albumen of the lymph and chyle.

The shut sacs of the body, generally, are lined with serous tissue and become the repositories of nervo-vital fluid. Hence, when any portion of that tissue is inflamed, the excited nervous action, circulating an increased quantity of nervo-vital fluid, gives a full and hard pulse; whereas excited nervous action on mucous tissues, passing off this same fluid too rapidly to the atmosphere around, creates a rapid and feeble pulse.

In regard to the white globules or lymph corpuscles, which are found in the blood, they are evidently allied in character to the primary cells, which repair the system as already explained.

Experiments have conclusively shown, that repeated venesec-

tions reduce the quantity of red corpuscles and of albumen in the blood, but do not readily affect appreciably the amount of fibrine. The explanation of this truth is as follows. As the veins are being partially emptied of their contents, they collapse upon the remaining current, for the time being; but they are soon filled again by the absorption of a watery liquid from the system. The blood abstracted diminishes proportionally the corpuscles, the albumen, and the fibrine; but the last being elaborated, to a considerable extent, in the lymphatic vessels, those vessels, almost immediately, supply a quantity nearly equivalent to what has been removed. The red corpuscles elaborated in the blood-vessels, and the albumen of the serum which escapes the fibrinizing power, are not subjected to influences to give them so rapid an accumulation.

CHAPTER VII.

THE FORMATION OF PUS.

That pus is *very commonly* formed, in connexion with the production of granulations is admitted by all; but whether it is always so formed,—what its precise nature is,—and by what means it is created, are questions which, till of late, have been quite unsettled.

Pus appears under various modifications, and circumstances will rapidly change its qualities. *Well-formed* pus is an opaque, smooth, yellowish fluid, without scent, and having nearly the consistence of cream. By the old writers, it was spoken of as *laudable* pus; and it is still quite frequently called *healthy* pus. The latter epithets, *laudable* and *healthy*, are unfortunate ones. They were selected when the most incorrect and absurd notions prevailed in regard to the reparative process. A degree of inflammation was considered benign in its influence, and as constituting, in itself, the process of healing. Well-formed pus always indicated, that, to some extent, reparation was going on. So, as it would seem, it was taken as evidence of a very *laudable* trait in the government of that superintending power, the *vis medicatrix naturæ;*

or as evidence, that *healthy inflammation* was restoring the part diseased.

Well-formed pus consists of yellowish globules, diffused through a thin fluid, which somewhat resembles the serum of the blood. "If six or eight ounces of good pus be suffered to stand in a phial, it will separate into two portions. A yellowish matter will sink to the bottom, and there will be a slightly yellow, clear, supernatant fluid, like oil in appearance, but not greasy to the touch." The sediment consists of the globules; and, by some, they have been regarded as the blood corpuscles, deprived of their coloring matter, and modified in form. To this view, however, there are, at least, two objections. The most prevalent opinion of physiologists, at present, is that the red corpuscles take no part in the formative process; and, to my own mind, it is pretty clear, that an entirely different office is assigned them, in the discharge of which they do not leave the vascular system, and cannot, therefore, appear, with the granulations, upon any surface. The other objection, alluded to, has respect to the rapidity and the kind of change which the pus globules are apt to undergo, on exposure to the air. The blood corpuscles, by a like exposure, coagulate and form a clot; whereas the change wrought on the pus globules, is clearly one of degeneracy or decay.

But pus is not always *well-formed.* Sometimes, the globules do not bear a due proportion to the watery part; and then the pus is called *ichorous.* When some of the coloring matter of the blood happens to be effused or extravasated and combined with it, it is spoken of as *sanious.* Mucus may be mixed with it, rendering it viscid and slimy. In scrofulous persons, diseased lymph may blend with it, and give it flaky and curdled appearance. Occasionally, morbific or effete matter, in the system, may find an outlet, in connexion with pus, giving it a fetid odor. When, by a breaking down of tissues, to some extent, a cavity forms abnormally in the system for the reception of pus, that cavity is termed an abscess; and pus from abscesses which form in or near the alimentary canal, is peculiarly liable to be offensive in character. This fact is probably owing to the tendency of the system to depuration through mucous surfaces, and to the existence, near those surfaces, of matter which needs to be eliminated.

According to Lebert, a French writer, as translated by Dr. John A. Swett of New York, pus globules "are always found floating free in serum. Their mean diameter is from .01 to .0125 of a millimetre. Their shape is spherical. Their surface is slightly rough, and is sometimes covered by molecular granules. Their investing membrane is more or less transparent. Their contents are liquid; and you can notice in them, when they have attained their full size, one, two, three, rarely four or five true nuclei, whose diameters are from .0033 to .005 of a millimetre, and in the interior of which a nucleolus can often be detected.

"With a high magnifying power, it is easy to discover these nuclei without the aid of any chemical reagent. The acetic acid, however, renders them more distinct."

Bearing in mind that the pathological and surgical writers, generally, have not distinguished the reparative process from inflammation, we shall see, by their writings, that they considered suppuration to be a process necessarily succeeding the formation of new tissue. Dr. John Hunter says, "The new-formed matter peculiar to suppuration is a remove farther from the nature of the blood than the matter formed by adhesive inflammation." Dr. Thomas Watson says, "Pus appears to be poured forth or secreted by coagulable lymph, after it has become organized. Its formation seems to characterize a more advanced stage of inflammation—to denote that the inflammation has been pressed a little beyond the adhesive stage." Dr. S. G. Morton, speaking of exudation corpuscles and false membranes, says, "By tracing the metamorphosis a single step further, we come to the *pus-globule.*" Dr. Watson does, indeed, say, that, "in the natural cavities of the body, pus seems, sometimes, to mingle gradually with the serous effusion, which grows turbid and whitish, and at length distinctly assumes a puriform character." But, whether he intended this remark to involve an exception to the usual manner in which pus is formed, or not, it is clear to my own mind, that, in fact, he only describes a case in which the reparative process goes on slowly, and is, at the same time, attended with but a slight elaboration of pus. Just that condition of things must be induced, when the vital or recuperative power is not strong, and yet, as in

a shut sac, there is not great irritating or destructive influence at work to counteract the granulating process.

Let us suppose, then, that suppuration is, ordinarily, an interruption of action in the formation of granulations, and that it is never a direct secretion from the blood, irrespective of tissue forming or formed. Still, another question arises whether false membranes and other granulation structures, which gradually disappear during the existence of suppuration, are not converted into pus; and whether even old tissues, which are broken down in the case of ulceration, do not undergo the same connection. On this question, I remark,—we know, that often granulations are removed by interstitial absorption, when there is no suppuration; and we know, that, in ulceration, matter often loses its vitality and breaks away from the living tissue, just as in a simple case of mortification. Antecedently, therefore, to a consideration of the true nature of suppuration, the probabilities are, that existing tissues, whether temporary or permanent, are always removed by other means.

But what is the true nature of pus? or what is the kind of action which elaborates it? I regard suppuration as simply a degeneration and disintegration of the organized hyaline fluid, or exudation corpuscles just as they are being deposited, in the granulating process. The change always supposes a reduced state of vitality in these corpuscles, by which they, in a measure, lose their power of organization, and become a kind of loose aplastic material.

With the loss of vitality, there is, also, in the material involved a chemical change, which consists, mainly, in an increased oxidation of that material. Well-formed, pus "is composed chemically of water, deutoxide of proteine forming the cell-walls, tritoxide of proteine and albumen in solution, fat, osmazome, and other extractive matters, and the same salts as those in the blood." In a more general description of these, however, it is sufficient to say, that the more solid parts are deutoxide of proteine, and the more dissolved or liquid parts, the tritoxide.

"Microscopically, pus consists of a limpid serum, and very numerous globules of pretty regular size and form," or of such glob-

ules containing such serum. "These globules have much resemblance to granular cells or exudation corpuscles; but they are larger, and are more distinctly and constantly provided with a cell-wall and nucleus, in addition to granules and molecules." In form, they are generally "spherical," though "sometimes irregularly rounded or oval. Their cell-wall is commonly opaque and somewhat uneven, from being studded with minute granules." "Pus globules are," in general, "larger than exudation corpuscles, even exceeding in size the blood-discs. According to Mr. Addison, they measure from 1-2000 to 1-1500 of an inch." They are evidently a modification of exudation corpuscles.

Physically, pus globules are without great power of cohesion. In this respect, they are in contrast, with the primordial cells and the red corpuscles. This physical effect, however, is, doubtless, the result of a chemical change.

The circumstances which give rise to suppuration are mainly three; an increase of inflammation, an irritating influence of air, and a certain depraved condition of the blood. It is easy to illustrate, at least in part, the manner in which these circumstances produce their effect, and increase the oxidation of the material concerned. It is, however, only necessary for me here to say, that it belongs to the nature of inflammation to expose the affected part to the reception of more oxygen; the pressure of the air does the same directly, and likewise increases the inflammation; and a certain depraved condition of the blood irritates and tends to the same result.

All these influences, where the vital powers are at work, feebly and under embarrassments, are sufficient to give chemical laws the ascendency over vital, and thus to produce the effect, of degenerating and destroying the imperfectly organized material which is about to form a temporary tissue. But, when once that tissue is formed,—especially, when the more perfect organization of permanent tissue is produced, it is not to be expected, that the kind of chemical influence referred to can be made to overcome vital influences. In this view of the subject, we perceive, that to speak of pus as a secretion, is not philosophically correct. Liquor sanguinis is secreted, and subsequently undergoes vital changes, upon the surface. Indeed, if a surface which is suppurating be fre-

quently sponged, a thin fluid only will, from time to time, be discovered, and no pus, as such, will be seen. The simple reason is, it has not time to form.

What has thus been said of the nature of suppuration throws important light on the question how the absorption of pus produces hectic fever. In the first place, the loss of vitality in what is absorbed renders it foreign matter; and that, when absorbed, always produces more or less constitutional disturbance. In the next place, the increased size of the pus globules must render them exceedingly irritating in their forced passage through the capillaries. And, finally, the soluble tritoxide of proteine, which is a prominent part of pus, acts, chemically, as an irritant. It will even dissolve dead animal matter; and it, doubtless, has an injurious effect, wherever it travels in the human system.

CHAPTER VIII.

ULCERATION.

In ulceration there is a breaking-down and removal of tissue, essentially in the same manner as in mortification. The loss of vitality, in the part, however, is gradual; and, at the same time, there is, in immediate proximity to the decaying part, a struggling and partially successful effort of vitality. By this effort, granulations are being formed, though they are also being disintegrated, in part, and converted into pus.

In the case of an abscess, the hyaline fluid forms an organized or exudation membrane, around a limited part, and thereby defends the exterior structure from the noxious influence of the gathering pus. This membrane has been called *pyogenic*, on account of its *supposed* office of secreting pus. We have seen, however, that pus is not a secretion. Still, the name, for distinction's sake, may well enough be retained. This pyogenic membrane varies somewhat, in its strength and influence, according to circumstances. Very commonly, it affords the least resistance in the direction of some cutaneous or mucous surface, and the abscess is said *to point* in that direction. The parts there are put more upon

the stretch, the vessels are more obstructed, the vitality is diminished, and the liquor sanguinis is less secreted. Fibrous and other hard textures generally resist pretty fully the progress of abscesses and the escape of pus. "Serous membranes, by their ready plastic process, first adhere together, and then often give passage to the contents of an abscess through them," thereby forbidding the escape of any pus into the sacs which they form. After an abscess has opened and discharged its contents, the granulation process, to an extent, gets the ascendancy of the morbid chemical influences; and, though the superficial layer of exudation corpuscles degenerates, more or less, into pus, the healing process is, in time, effected, and the cavity is obliterated.

Sometimes ulcers form superficially. Inflammation gives origin to the destruction of the tegumentary, and portions of deeper-seated tissues. They lose their vitality, and are either absorbed or carried away with the pus discharged. The excavation being greater, in some portions than in others, often gives a ragged form to the ulcer. Sometimes, especially when the impurity of the blood enfeebles the vital power, the reparative process will go on but imperfectly, and the pus discharged, or a portion of it, will not be well-formed. It may be ichorous or sanious, or may, by other characteristics, show the weakness of the vital action; but, as soon as the vital energies, working by fixed laws, begin to get the ascendancy, well-formed pus takes the place of that of other traits, and granulations, to a greater or less extent, restore the part.

In general, ulceration has its origin in a suspension of the normal nutrition of the part, by means of inflammation. Frequently, however, it is immediately preceded by an induration which is produced by some abnormal deposit, either from the blood vessels, or from the lymphatic system, or from both. In this case, "the ulceration commences in the centre of the induration, because the nutrient influence of the vessels is most reduced, by the pressure at that spot." Sometimes, it would seem, that the impoverished and impure condition of the blood gives rise to ulceration, without its being preceded by induration or inflammation. This especially happens in parts, the blood vessels of which become congested by posture; and in the non-vascular textures, which are not nourished the most directly by the blood.

CHAPTER IX.

MORTIFICATION.

Mortification consists in the decay of animal tissue, in consequence of a suspension of circulation in the part, or of the blood's having, in a great degree, lost its vital properties. The part dies; and, if the vital energies in the parts immediately around are sufficiently energetic, the reparative process is immediately set up, and, by means of it, the dead portion is separated or *sloughed* from the living. If, however, the vital power in the surrounding parts is but feeble, and the separating process takes place but slowly, decomposition will, to an extent, ensue, while the dead portion remains attached to the living.

For convenience's sake, degrees of mortification have been expressed by different terms. When the death of the part seems entire, when the color is a dark bronze or almost black, and when sensible decay is going forward, the mortification is called *sphacelus.* On the other hand, when vitality seems gradually to depart, when the color is only livid or a greenish yellow, and when decay is not yet sensible, the mortification is called *gangrene.* These terms, however, are not always used with precision.

When the vital energies have been sufficient to cause a sloughing of the mortified part, immediately the granulating process will appear, attended with suppuration. Sometimes, when a part is gangrenous, and even when its mortification seems almost entire, it will be, in a measure, supplied with warmth and moisture from the healthy adjoining tissue, it will exhale an offensive odor, and, if it be upon the surface of the body, the cuticle will run in blisters. At other times, the mortified portion becomes dark-colored, dry, and horny, but does not rapidly putrify. It is then called *dry mortification* or *dry gangrene.*

When the mortification is internal, as the matter becomes putrid, it is liable, by being pent up, to affect the living body and produce constitutional symptoms. If, however, the constitution be vigorous, and the reparative process be well established, the living parts will be more or less protected from the infectious influence of the

dead matter; but, in persons of feeble constitution, whose blood is deficient in plastic power, the infection will be felt, and typhoid or putrid symptoms will appear. And, in general, it may be said, that no living parts, however great their activity, can long resist the pernicious influence of dead matter in connexion with them, without experiencing a poisoning or injurious effect.

CHAPTER X.

LYMPHATIC SWELLINGS.

Besides the enlargements produced by inflammation and serous effusion, there are forms of swelling which arise from an accumulation of lymph in the part. The lymph is detained in the lymphatic vessels, and over-distends them. Of course, the part is enlarged.

Such an enlargement, when it exists simply, may be called lymphatic congestion. In some cases of ague, nervous swelling, &c., the enlargement is little more than congestion of the lymphatic vessels. When, for instance, the face suddenly swells, in consequence of diseased teeth and a disordered condition of the nerves connected with those teeth, the effect is evidently lymphatic congestion. So, too, when the abdomen suddenly puffs up, by means of disordered uterine action, the puffiness is immediately caused by lymph detained in the lymphatic vessels. The nerves connected with this set of vessels, become weakened in their power, and the lymph does not pass with its normal rapidity; —it accumulates in the part affected. Such, at least, is my view of this matter.

There are, however, modifications of this condition. Not unfrequently, lymph is detained in the glands, until it becomes hardened and assumes a pasty appearance. Inflammation is set up in and around the glands, and so the enlargement is compound in its character. It arises partly from lymphatic congestion, and partly from inflammation. Scrofulous enlargements of glands about the neck, in the axilla, in the groin, and in other localities, are instances of this compound character of disease. So, also,

are those scrofulous swellings which, at length, take on the character of abscesses. Here, too, I confidently rank the case of phlegmasia dolens. The swelling is mainly owing to the lymphatic congestion, while phlebitis and perhaps inflammation of different tissues, to some extent, attend the lymphatic disturbance.

CHAPTER XI.

TUBERCLES.

According to Dr. Wm. B. Carpenter, tubercle is a degenerated form of the exudation corpuscle. It is unpossessed of organization, and exists, like a foreign body, in the tissues in which it is deposited. It consists of albumen, with a greater or less admixture of fibrine. It generally exhibits no other trace of structure, than a congeries of minute albuminous granules, mingled with shapeless flakes or filaments; but cytoblasts and cells may be occasionally detected in it, especially when it is recently formed.

Dr. Carpenter, also, supposes, that tuberculous matter is deposited in persons of a scrofulous habit, in the same manner as what he calls organizable lymph is deposited in persons of sounder constitutions; or, as I should say, in the same manner as granulations or exudation membranes are formed. He, also, further says, that "the difference between a deposit of tubercle and the *effusion* (I should say *secretion*) of plastic lymph consists in this,—that the former is composed of the albuminous constituent of the blood, a mere chemical compound, which is not prepared to undergo organization until it has passed through the condition of fibrine, whilst the latter is a portion of the vitalized fibrine, which possesses within itself the tendency to organization and only requires the contact of a living membrane to enable it to pass into a regular structure." He, however, admits "that tubercular matter may be deposited by a perversion of the ordinary process of nutrition, without anything like an inflammatory state." "Unorganizable albumen" takes the place "of organized fibrine."

That these views of Dr. Carpenter are not very remote from the truth, is sufficiently clear, in the present light of pathological

science; and yet, to my own mind, it is equally clear, that a crude and peculiar organization characterizes tubercle. It is something more than a mere chemical compound. It is a somewhat vitalized, though a cacoplastic deposit. It is "the result," says Dr. C. J. B. Williams, "of modified textual nutrition. The cell-germs, by which the material of textures is renewed, are imperfect at particular points; a granular or amorphous matter is deposited from the plasma, and concretes without fibres or regular cells' being developed. At this point a granulation appears, and gradually hardens. When a granule has once been formed, it becomes a nucleus for the concretion of more; a new habit or mode of nourishment is established at the spot; or, to speak less figuratively, cacoplastic matter (if present in the blood plasma) concretes around it by a process similar to that by which fat attracts fat, or bone osseous matter. Perhaps the process is not wholly unlike that of crystalization. But, however it happens, the result is, that the granular tubercle grows, and may attain the size of a millet-seed, hemp seed, or even a small cherry stone; or, being subjected to pressure, may slightly spread or flatten into various shapes.

"The microscopic character of these miliary or granular tubercles is the complete predominence of minute and often irregular granules, and the comparative absence of fibres and cells, of which mere traces are seen, at least in the older specimens. The granules are aggregated together by an amorphous material, the solidity of which gives hardness and some transparency to the mass. The chemical nature of granular tubercle is albuminous, with some gelatine, and a little fat, the latter in very minute proportion, and occupying the centre of some granules, and the gelatine being, probably, the amorphous cement just noticed. In all these characters, we find a close analogy to the granular degeneration of textures, of which, doubtless, these deposits are a kind of exaggeration.

"Tubercles rarely grow much or last long, without exhibiting another change in their appearance. They lose their semi-transparency, and become of an opaque or dead pale yellow hue, like the color of raw potato or parsnip. This is the transformation to crude yellow tubercle, first described by Laennec. This change is the result of a further degradation or degeneration of the de-

posit. The few fibres and cells which are to be detected in gray tubercle become indistinct, the interstitial hyaline or amorphous solid diminishes, and oil globules appear in its stead, and the mass becomes less coherent and more granular, and therefore quite *aplastic*. Generally, the change begins in the centre of the mass; apparently because, being devoid of vessels, the centre is further removed from the vivifying influence of the blood.

"But tubercle is frequently deposited at first in this yellow opaque state,—this circumstance being a mark of the still more degraded condition of the nutritive function; and the more extensive forms of tuberculous disease commonly abound in this aplastic matter. Thus, in rapid phthisis, yellow tubercle commonly forms a large portion of the deposit. Yellow tubercle is rarely so hard or so tough as the gray or semi-transparent kind; and, in the cases of rapid deposit, just mentioned, it is often much softer and more friable. Now, this is the commencement of a change to which the lowest forms of tubercle tend,—that of *maturation* and *softening* into a cheesy substance." In the softening of tubercle, "the deposit becomes less dense, and loses the little trace of structure which it possessed. It degenerates into an amorphous granular mass; and, being lifeless, it is no longer nourished. Its granules lose their cohesion and become disintegrated by the chemical action of the adjoining fluids. Mr. Gulliver and others have observed a remarkable increase of fat globules in softened tubercle. In fact, from the time that tubercle assumes the opaque form, these oil globules appear to increase, until it either is softened and eliminated, or undergoes a kind of "petrifactive change,"—a chemical and mineral transformation.

But the microscopic character of tuberculous deposits is that by which they are specially discriminated. This character is admirably described by Lebert who, at present, "is the highest authority in France on this subject, and is, perhaps unsurpassed, by any microscopist now in existence, in microscopic pathology." I add a portion of what he says on this subject, in the translation of Dr. John A. Swett of New York.

"The constant elements of tubercle are:

"1st. A great number of molecular granules, perfectly round, of a grayish-white color, or with a slight yellow tint, sometimes

compact, sometimes transparent in their centres, with a diameter of ·0012 to ·0025 of a millimetre. These granules completely surround the tubercle globule, so that it is often difficult to recognize it in the crude yellow tubercle. They are seen in much greater numbers, and quite disaggregated, in the softened tubercle.

"2d. These granules, as also the tubercle globule, are united with each other by an intergranular, interglobular, hyaline substance, of considerable consistence, which serves as a cement to the elements of tubercle, and which becomes liquefied by softening.

"3d. If the two elements which I have just described possess no peculiarities which belong to tubercle, and which do not distinguish it from other morbid products, there is a third element which is much more important, which, in fact, is entirely characteristic of, and peculiar to tubercle—*the tubercle globule, or cell.*

"The form of the tubercle globules is seldom perfectly round, although it is probable, that, at the time of their excretion by the capillaries, they do assume a form more or less spherical, and that they afterwards assume a less regular shape, often becoming angular, on account of their close juxtaposition. Thus, as they commonly appear under the microscope, especially in the crude tubercle, their outline is irregular, approaching sometimes to the sphere, sometimes to an oval; but generally they are irregularly angular and many-sided, with the angles and the edges rounded, as is very evident when they are suspended in water or in serum. Their color is a clear yellow, assuming a blackish tint when a high magnifying power is employed. Their interior is irregular and of unequal consistence, which gives them a spotted appearance, independently of the granules which they may contain. But I have never been able to detect a true nucleus in these globules, although they sometimes present in their interior the appearance of an irregular vacuum, which resembles a nucleus. I have always examined this point with great attention, using the highest and the best defining magnifying powers, as well as different chemical re-agents. We cannot consider the granules, which are irregularly distributed in the substance of the tubercle globule, as nuclei. These are only molecular granules, whose diameters seldom reach, and never exceed, ·0025 of a millimetre; often, indeed, they are

not more than ·0012 to ·0015 of a millimetre. These granules, variable in number from 3, 5, to 10, or more, are not regularly distributed, and are not all visible in the same focus. The intergranular substance of the globules surrounds them, so that they are not ordinarily encompassed by a transparent areola. The interior of these granules appears opaque.

"The diameter of the tubercle globule varies. In the rounded globules, it ranges between ·005 and ·0075 of a millimetre, rarely extending to ·01 of a millimetre. The oval globules, as a mean, are ·0075 of a millimetre in length, and ·005 to ·006 of a millimetre in breadth. The diameter of the tubercle globule increases at the commencement of the period of softening.

"The diameter of the tubercle globule varies within certain limits; but this variation is independent of age and of the tissue or organ in which the deposit has formed. It is more easily recognized in the yellow crude tubercle, than in the gray miliary granulation. In the recent tubercle, the tubercle globule is detected with difficulty, because it is concealed by the interglobular hyaline membrane which unites the globules, and by a large number of molecular granules which surround them.

"It is important, therefore, in commencing the study of the tubercle globule, to select for examination a yellow cheesy tubercle, not too hard nor too soft, to disaggregate it with needles, in a drop of water, which can, however, never be done completely; and this difficulty is one of the most striking characteristics of the tuberculous deposit. It is well, after this has been done, to let the preparation dry a little between the plates of glass, in order that as many globules as possible may be seen at the same focus. The distinctness of the view may be increased by a fine diaphragm and by a good light. A lamp is, however, not as favorable for the examination of tubercle as the daylight; and, if the lamp is employed, care must be taken that the light is not too strong. We having thus become familiar with all the details of the tubercle globule, it will be easily recognized whenever it is present. By this method, then, the tuberculous deposit can be readily distinguished from all other morbid products, a result which, in doubtful cases, no other mode of examination is capable of producing.

Water does not change the tubercle globule. Acetic acid renders it more transparent without changing it much, and establishes the absence of nuclei in its interior. It is a very valuable mode of distinguishing the tubercle globule from other globules resembling it, except that they contain one or more nuclei. Acetic acid is especially useful in distinguishing the tubercle globule from the pus globule. Ether and alcohol react very slightly upon the tubercle globule. Strong ammonia renders it, at first, more transparent; it then dissolves the intergranular substance, and allows the molecular granules contained in it to become separated. A concentrated solution of caustic potassa completely dissolves the tubercle globule. The concentrated acids, especially the hydrochloric and the sulphuric acids, also dissolve it, but more slowly.

"What is the position which the tubercle globule is entitled to occupy among the pathological cells? If it be true, that a perfect cell is composed of an investing membrane, and of one or two nuclei, and of nucleoli in the interior of these nuclei; yet I am convinced, from many observations of pathological cells, as well as of those found in healthy organs, that this mode of cell-formation is by no means universal, and only peculiar to a certain number of elementary globules. The tubercle globule appears to me to be one of the most simple forms of pathological cells, being composed of an enveloping membrane, containing a semi-liquid substance and a certain number of molecular granules irregularly scattered through it, as in the pyoid globule. This pyoid globule, however (,which is a variety of the development of the pus globule), differs from the tubercle globule in being more regularly spherical, more pale, more transparent, and by containing granules which are transparent in their centres, and seated in the periphery of the pyoid globule.

"I will now pass to the study of the softened tubercle, limiting myself, for the present, to indicating the physical changes in the softened tubercle as revealed by the microscope, and reserving the physiological explanation for another place. In order to appreciate properly the changes which take place during the softening of the tuberculous matter, the use of the microscope is indispensable, for the reason, that the parts surrounding the tubercles often inflame and secrete pus, and then the elements of suppuration are

mixed with those of tubercle. As the naked eye cannot discover all these details, much confusion would exist without the aid of the microscope.

"I may say, in general terms, that the principal change that occurs in the tubercle, while softening, consists in the liquefaction of the interglobular hyaline substance, which is sufficiently solid and consistent in the crude tubercle to hold the tubercle globules in close union. But, in the softened tubercle, they become disaggregated, separated, although clustered groups may still be discovered. As the globules become free, they become more rounded, almost spherical; they become, at the same time, more transparent and more thin, and the blastema which surrounds them becomes more granular.

"Both by the naked eye and by the microscope, pus is frequently found united with softened tubercle. It would appear that the presence of pus hastens the decomposition of the tubercle globule, and this is one reason why the matter contained in tuberculous ulcers is so often without tubercle globules.

"Finally, it may be stated, that the tubercle globule disappears in a nearly perfect dissolution, after having been disaggregated into granules. These globules, then, undergo three phases of development. They are at first closely packed together, and compact in their interior. Then they separate from each other and increase in size, which, instead of being owing to a more perfect development, is, in fact, the commencement of decomposition, and is owing to an endosmosis of the surrounding blastema, which becomes more and more liquid. At last, these little globules, whose internal and molecular cohesion has already been disturbed, finally, by running together, form a yellow and a more or less liquid mass.

"There is some analogy in the mode in which the pus globule and the tubercle globule disappear. The former is disintegrated into granules before it can be absorbed.

"If the crude tubercle and the softened tubercle constitute the first two stages of this deposit, and the diffluence of the elements of tubercle the third stage of its evolution, there is still a fourth stage,—its passage into a cretaceous state. I can confirm the opinion that this cretaceous transformation of tubercle is one of

the most powerful means which nature employs to cure the tuberculous disease. Its microscopic composition is altogether in favor of this view of the question. At the commencement of this change, we can still recognize a considerable number of tubercle globules, and with them a kind of mineral dust formed of very fine granules, whose diameters are from ·001 to ·0015 of a millimetre, transparent in the centre, looking black under a high magnifying power, but under low power, as well as by the naked eye, having a yellowish-white tint, and being more resistant to compression than the soft elements of ordinary tubercle. These latter elements diminish in proportion as the granular, amorphous, mineral elements increase. They become more solid and dry, as the portions capable of dissolution are absorbed. The cretaceous tubercle often contains much black pigment, and many times I have met with a considerable number of crystals of cholesterine.

"Having described the elements which are essential to tubercle, I will next examine other elements which are not essential, but yet are of frequent occurrence.

"The pigment infiltration, or melanosis, which is also met with in many other morbid products, appears in three different forms. 1st. As a granular infiltration. 2d. As the contents of certain globules, having a diameter from ·016 to ·024 of a millimetre, and sometimes reaching ·033 of a millimetre. 3d. As fine granules contained in certain normal, or pathological cells. Thus it is frequently contained in epithelial cells, and expectorated in abundance.

"This pigment is also found surrounding pulmonary tubercles, as the gray granulation, the cretaceous tubercle, and tuberculous excavations. It is also often found in abundance in the bronchial glands. It is sometimes noticed in the mucous membrane of the intestine, and especially around tubercles of the peritoneum. It is a carbonaceous substance.

"Fat, in the form of fat vesicles, is frequently found in tubercles.

"It is not uncommon to find fibres in tubercle, but they very rarely belong to the tuberculous secretion. Generally, they are fibres of the tissue of the organ in which tubercle is secreted. Thus, the gray, semi-transparent tubercle in the lungs, often contains the elastic fibres of the cellular tissue of the lungs.

"In certain rare cases, crystals exist in tubercle. Once I met with three-sided prisms in tuberculous matter from the lungs; another time, in the bronchial glands; and, in a third case, rhomboidal plates of cholesterine in softened tubercle in the neck, which was not cretaceous.

"Another element not unfrequently met with, and which might easily lead to mistakes, are young epithelial cells, derived from the capillary bronchi when the lung is cut, having a diameter of ·0125 to ·015 of a millimetre. These are of an irregularly rounded shape, containing a nucleus with a diameter of ·005 of a millimetre, which sometimes contains a nucleolus, or a finely granulated matter. These cells are found in considerable number around agglomerated masses of tubercle globules, but never in the midst of them, so long as they are united by the intercellular hyaline substance. By the side of these round or oval young epithelial cells, are found the cylindric epithelial scales, with or without vibratile cilia, which could not easily be mistaken for tubercle globules.

"In conclusion, we find, as the constant and essential elements of tubercle, granules, and an interglobular hyaline substance, and globules peculiar to tubercle. After its excretion, the tubercle first assumes a compact form, then it softens, and at a still later period it dissolves; or it withers and becomes cretaceous. The elements which are not constant, but which are found more or less frequently in tubercle, are melanosis or black pigment, which is the most common, fat, fibres, globules of a decided color, and finally crystals, commonly those of cholesterine.

"As elements accidentally mixed with tubercles, we often find under the microscope different products of inflammation, of exudation, of suppuration, and of the epithelial secretion, globules of different kinds, which come from the tissues surrounding the tubercle, but which are never met with in the midst of its elements.

"In the gray semi-transparent granulation of the lungs, we always find a mixture of areolar fibres with a grayish hyaline substance and with tubercle globules. The fibres are composed of the elastic fibres of the pulmonary cellular tissue. The gray tint of the granulation is sometimes heightened by the admixture of the black pigment.

"The yellow opaque tubercle is identically the same as the gray semi-transparent tubercle, only, in the latter, the tubercle globules are smaller, and more closely packed in the substance which surrounds them. The yellowish aspect is produced by the confluence and increased size and abundance of the tubercle globules after the destruction of the surrounding fibres which tended to separate them, and at the same time the hyaline membrane becomes more opaque and granular.

"The gray, semi-transparent granulation is not the constant or the necessary commencement of the tuberculous deposit. It may occur originally as the yellow opaque granulation. Very small yellowish points make their appearance, in which the microscope discovers a few fibres, much less numerous than in the gray granulation. Their principal element is the tubercle globule, and the interglobular hyaline membrane is granular, and with very little transparency.

"The liquid which covers the internal aspect of tuberculous excavations contains, sometimes, tubercle globules in their perfect form; but generally they are more or less distended by the softening that has taken place, and most of them are in a state of diffluence. It also contains pus globules, the large granular globules of inflammation, a viscid mucous fluid, blood globules, pulmonary fibres, black pigment, epithelial scales, three-sided prisms, and fat vesicles.

"Under this liquid layer, composed of so many elements, are false membranes, composed of a fibrous stratified substance, and containing numerous pus globules.

"Beneath this layer of fibrine is the true lining membrane of the excavation—it is organized and vascular. Its structure is irregularly fibrous, and among the fibres are numerous small globules. Sometimes it contains but very few blood-vessels, and then the fibrous tissue is dense, white, and very abundant, appearing like cartilage. But I have never found in it the slightest traces of the elements of cartilage.

"The microscopic examination of the expectoration in tuberculous phthisis discloses the following facts: The matter contains, in the first place, substances which are not at all specific, as saliva mixed with mucus and epithelial scales from the mouth, which

latter are sometimes quite abundant; epithelial scales from the bronchi, mucus, vibriones, blood globules, crystals, black pigment, globules of fat, granular globules, and pus globules.

"Besides these, are noticed small masses or little pellicles, which at first sight might be mistaken for tuberculous matter. The microscope, however, only discloses globules of pus and a granular coagulation. These are probably false membranes coming from tuberculous cavities. Again, we notice masses like the preceding in appearance, in which the microscope only discloses numerous molecular granules, which are probably produced by diffluent tuberculous matter. Again, there are noticed amorphous mineral granules, which, perhaps, come from cretaceous tubercles. And, finally, we may meet with the true tubercle globule. But this is very rare. I am not sure, that I have ever met with it so distinctly that its existence was not doubtful. Sometimes pulmonary fibres are found in the expectoration. There is, then, nothing specific in the tuberculous expectoration."

CHAPTER XII.

CARCINOMA.

Carcinoma, from the Greek καρκινος, a crab, and synonymous with cancer, indicates a disease which has generally been considered to exist in three distinct forms. These forms are originally such, and not merely different stages of the disease; and they arise mainly from the different proportions and arrangements of the elements entering into the composition of the deposit. "These elements," Dr. Swett has well remarked, "are a fibrous tissue, and a viscid fluid, contained in cells and called the cancerous juice.

"If the fibrous tissue predominates, you will find the mass hard and creaking, when divided by the knife. You will notice that its cut surface is intersected by white lines, or by larger masses of a dense white structure. In the midst of these lines you will discover a finely granulated substance, contained in cells, which is the cancerous juice, and which may be pressed out by the finger or scraped off by the scalpel, when it often very much

resembles apple-juice, in appearance. This form of cancer is known as *scirrhus.*

"When the fibrous element is less distinct, and the cancerous juice more abundant, the cancerous mass is much softer in texture. It is often more distinctly granular; and, from its resemblance, in many cases, to the substance of the brain, it has been called *encephaloid.*

"Finally, the fibrous tissue may be still more deficient, or even entirely absent, and a jelly-like mass, sometimes semi-fluid or even fluid, and collected in cells, often of considerable size and united with cancer cells, may exist, constituting what has been called the *colloid* or gelatinous cancer."

But, in addition to this three-fold division of cancerous deposits, there are minor differences, which arise from accidental causes. —One of these respects the color. Commonly, the cancerous juice is semi-transparent and of a yellowish-white color. Its appearance has well been compared to that of apple-juice. Sometimes, however, the mixture of fatty matter gives it a greater yellowness; and then a mass, of the proper consistence, bears the resemblance of a tuberculous deposit; or, if it be more fluid in form, it very much resembles pus. Sometimes, too, the juice is of a milky-white color, and gives to the fibrous deposit an aspect almost white. Often the fibrous deposit is of a rosy-red appearance; or portions of it may take on a dark, and almost black or melanotic appearance.

The cancerous mass, also, varies much in form and general character. Sometimes, it is exceedingly vascular, and the vessels are easily ruptured. Often, it is loose and spongy in texture like the lungs. Again, its fibrous structure is close and unyielding. Sometimes, there is a large undivided mass; sometimes, minute particles are deposited in clusters; and, sometimes, there is an undefined infiltration into the tissues involved.

Generally, the deposit is at first of pretty firm consistence. In process of time, it softens and discharges a fluid. It is then called a cancerous ulcer. The terms fungus hæmatodes, rose cancer, &c., are very commonly employed to designate some of the appearances now described.

Chemically considered, the most abundant element in the com-

position of cancer is albumen. "It, also, contains," says Dr. Swett, "some fatty matter, and some fibrine, with inorganic salts, —as the sub-phosphate of lime, the carbonates of lime, soda, and magnesia, the hydrochlorates of soda and of potassa, the tartrate of soda, and the oxide of iron."

It is only microscopically, however, that cancer, as such, can be recognized with certainty. The elementary cancer cells or globules differ from all other cells, whether concerned with healthy or with diseased structures. The cancer cells are not, indeed, found alone, but they are mixed with other forms of matter; and these accidental ingredients assist in varying the visual appearance of the mass, as a whole. It is now admitted, that inflammatory indurations, non-malignant fibrous tumors, &c., when the eye is the only test employed, are liable to be mistaken for true carcinoma. Hence the importance of a means of diagnosis on which reliance may be unerringly placed. This means is found in microscopy.

In illustration of the microscopical character of cancer, I quote from Lebert's work on Pathological Anatomy, as translated by Dr. Swett.

"Authors of much merit have denied that the microscopic elements of cancer were characteristic. I have arrived at an opposite conclusion, and I maintain that the cancer globule has striking characteristics which distinguish it from every other form of morbid product. It must not be forgotten, that there are certain general forms of cells and of nuclei, the types of which are met with in very different products. But this I maintain, that the different pathological products which are composed of elementary globules, individually present certain characteristics by which they can be distinguished by those somewhat accustomed to the use of the microscope. I will go even further, and state that the cancer globule is one of the cells which possess the most striking characteristic features to distinguish it from every other kind of cell. It is important, however, to add. that the cancer globule is subject to very many variations; but I hope, by pointing out these varieties carefully, and at the same time by explaining the sources of mistake, and the difficulties in the diagnosis, to place before the reader their peculiar characteristics.

"Not only the globules of cancer, but even their nuclei, are larger than the entire tubercle globule. The globules of scirrhus have a diameter of ·0175 to ·02 of a millimetre, and sometimes of ·025 of a millimetre. Their outline is regular, their appearance pale, and their surface is finely dotted with minute granules, which are situated between the investing membrane and the nucleus. This nucleus is commonly single, but sometimes double, and with a strongly marked outline, round or oval, and with a diameter of from ·0125 to ·015 of a millimetre. These nuclei are often found freed from their investing membrane. When this is the case, and a large number of these free nuclei are clustered together, they resemble somewhat tubercle globules; but the differences in the diameters, in the outline, in the central substance, and in the existence of a certain number of perfect cancerous globules, will remove any doubt that may exist.

"The globules of encephaloid, which are very much like those of scirrhus; or rather the nucleus of the true encephaloid globule—for authors have generally mistaken the nucleus for the perfect globule—has a diameter from ·01 to ·015 of a millimetre. Its shape is a very regular sphere, or oval, with a marked outline finely shaded all around its internal circumference, containing, besides a fine granular matter, one, two, rarely three round nucleoli, with diameters of from ·0025 to ·0033 of a millimetre, and transparent at the centre. A fact which establishes the diagnosis still more clearly is, that, when the globules are perfectly formed, they are surrounded by an investing membrane, which is often irregular in shape. The whole globule thus represented has a diameter of ·015 to ·02 of a millimetre, and sometimes even of ·035 of a millimetre, and possesses characteristics peculiar to itself.

"The cancer globule is composed of an enveloping membrane, and a nucleus which contains nucleoli. The diameter of the external cell varies in different cases. Its mean diameter is ·02 of a millimetre. Sometimes it is only ·015 of a millimetre. Very often it is much greater, extending to ·03 of a millimetre, or even beyond that point. Its shape is round or ovoid—round more frequently in the globule of encephaloid, a little elongated in the globule of scirrhus. In many cases it is easy to trace the progress of one of these forms, as it passes into the other

form. Very frequently this external enveloping membrane assumes many different forms. It is generally more flattened than the nucleus. Sometimes it is pale, and perfectly transparent. At other times it is covered by fine dots; and quite frequently it is so filled with granules that it exactly resembles the large granular globules of inflammation. It is also not uncommon to meet with both regular and irregular globules, which contain a certain number of nuclei; and we may discover large parent cells, with a diameter reaching even to ·05 of a millimetre, of a rounded or oval shape, which contain four, five, six, or even a greater number of nuclei. At other times we meet with large membranous expansions, in which we can distinguish a considerable number of nuclei, surrounded by a granular and dotted mass.

"The nuclei vary in their diameters from ·0075 to ·02 of a millimetre. The smaller are found chiefly in the perfect globules of scirrhus. The large round or elliptical nuclei, with diameters extending from ·015 to ·02 of a millimetre, are principally found in the encephaloid cancer. In some forms of cancer these nuclei constitute so decidedly the predominating element under the microscope, that we might be tempted to assume that they were the type of the cancer globule, did we not observe these same globules in their more perfect form, that is, with their enveloping membrane, in other cases of cancer. These nuclei are sometimes very pale. At other times, and this is especially the case in scirrhus, their outline is very distinct. In many cases of encephaloid they present a characteristic shading at their whole circumference. In a certain number of cases the enveloping membrane of the cancer globule is elongated, pointed at each end, and even at several points of its circumference. It then bears some resemblance to the fusiform fibro-plastic bodies. It can always, however, be readily distinguished from these bodies by its much greater size, by being much less elongated, and by its characteristic nuclei and nucleoli.

"If the nuclei and nucleoli of the cancer globule always possessed the distinct form which I have just described, nothing could be more easy than to detect them by a microscopic examination. But, as it generally happens that cancer is mixed with much fatty matter, the nuclei are found to undergo different changes on this

account. Thus we often find them filled with granules and small grumous masses. Sometimes, indeed, they are infiltrated with a homogeneous and confluent fatty matter.

"The nucleoli have a diameter which varies from ·0025 to ·0033 of a millimetre, and even to ·01 of a millimetre. Their number is from one to five. But, as the nuclei which contain them are somewhat thick and spherical, we cannot recognize them all under the microscope at the same focal distance. These nucleoli have a peculiar character. Their outline is distinct, but their interior is seldom transparent—ordinarily it is dull and homogeneous. I was for a long time in doubt what these nucleoli were; but I have recently discovered that they are imperfectly developed nuclei. In examining some large nucleoli under a magnifying power of 1000 diameters, I saw that they contained two or three secondary nucleoli.

"It is not uncommon to meet, in cancer, with large concentric cells with a diameter from ·04 to ·05 of a millimetre, and with thick walls inclosing many concentric globules.

"The cancer globule appears to me to be formed in this way: The capillaries excrete the cancerous matter in a liquid state. In this liquid, nuclei form, and soon after nucleoli. Possibly the nucleoli may form first. Around the nucleus, molecules of the liquid blastema first excreted arrange themselves, so as to form irregular enveloping shreds, or regular rounded or oval globules. It may possibly be the case that these concentric globules are only ordinary cancer globules, all the portions of which are remarkably developed. I have also seen the cancer globules assume the appearance of clustering when they were filled with granules of fat, and when the nuclei also were deformed by the infiltration of fatty matter.

"It is not reasonable to suppose that the cancer globules, which are first secreted, continue to exist for a long time. After a time they become deformed, they lose their distinct outline, and are finally dissolved into granules. At the same time, the excreted blastema which is constantly being poured out by the vessels, forms new cells. Thus, a certain number of the cancer globules appear incompletely developed, others are well developed, and a certain number are undergoing decomposition.

"The cancer globule of scirrhus is ordinarily furnished with an

enveloping membrane, which is round, ovoid, or irregular in shape. Its mean diameter varies from ·015 to ·02 of a millimetre. It is finely dotted all around the nucleus. This nucleus is small, its diameter varying from ·0075 to ·01 of a millimetre. Its outline is very sharp, and it exhibits, in its interior, granules and little masses (grumeaux), and sometimes nucleoli.

"The cancer globule of encephaloid is surrounded by an envelope, regular or irregular in shape, having a diameter between ·02 and ·03 of a millimetre. The nucleus is spherical, or very often elliptical, pale, shaded at its circumference, and containing from one to three very distinct nucleoli. Generally, as already stated, the nuclei are seen under the microscope in greater number than the perfect cells. Frequently every form intermediate to these two types of the cancer globule will be noticed.

"Next to the cancer globule, which is the characteristic element, is the fibrous element, which is sometimes the predominating element. It presents very different appearances in different cases. In scirrhus, it is formed by a network of fibres arranged in bundles, which cross each other in every direction, and communicate with each other by fibres, which pass from one bundle to another. The primitive fibres, in this case, are well defined. They are delicate, and do not exceed in breadth the ·0025 of a millimetre. They are generally less tortuous than the fibres of ordinary cellular tissue. In some cases these fibres interlace with each other without being arranged in bundles. In certain organs, especially in cancer of the mamma, there are numerous elastic fibres. In some exceptional cases, I have met with a fibroid network, inclosing in its meshes cancer globules and resembling exactly coagulated fibrine. In the soft encephaloid cancer, the fibres are pale and delicate, and much less numerous than in scirrhus. Nevertheless, I have met with cases of medullary cancer, in which the encephaloid matter was inclosed in a dense and fasciculated fibrous stroma.

"Fusiform bodies, such as are met with in other morbid products, are very frequently seen in cancer. They are distinguished from the fusiform cancer globule by the difference in their nuclei, that of the cancer globules being much larger.

"These fibres, these fusiform fibro-plastic globules are formed

from the exuded blastema, as is also fat, pigment, and other substances.

"After the cancer globules, the fibres, and the fusiform bodies, the substance which is met with most frequently and abundantly in cancer, is fat. It is seldom absent, and it is sometimes so abundant and so mixed with the cancer globules, that they can hardly be distinguished. The fatty element occurs under the forms of granules, of free fat vesicles, fatty spots, and cholesterine. The granules are commonly found in abundance outside the cancer globules; but very often, also, they exist in their interior, and then we can distinctly trace the change from a simple cancer globule to that which resembles exactly the large granular globules of inflammation. Frequently, these granules are deposited in the nuclei of encephaloid globules. But that which renders these globules not easily recognizable, is the fact that fat is frequently deposited in them which is confluent and homogeneous in its character. Their outline is thus altered, and it requires great attention to distinguish them. It is these globules which constitute the fatty matter which looks like tubercle, an appearance noticed especially in sarcocele.

"Large granular globules analogous to those noticed as the product of inflammation, with a diameter of from ·02 to ·03 of a millimetre, are commonly noticed in cancer. I have already stated that the cancer globule when infiltrated with fat, may assume the appearance of these inflammatory globules. But I think that the true inflammatory globule is also often found in cancer. When it is examined by a low power and by direct light, it appears in groups of a dull white or yellowish aspect. With a high power, and by reflected light, it appears of a blackish-brown color. It is usually so spherical, that it can be burst by compression, and made to discharge numerous granules. These globules are found in all kinds of cancer. I have sometimes seen them existing as a general infiltration into the cancerous mass, and sometimes forming a network of a dull-white color, constituting the reticulated figures so well described by Muller. They can sometimes be enucleated and studied separately.

"The black pigment or melanosis, both in the form of granules and of globules, is found in both scirrhus and encephaloid cancers.

"I have also noticed a peculiar coloring matter, of a yellowish tint, which I have named *Xanthosis*. It varies from a saffron to an orange tint. It appears to be a kind of fatty matter.

"Crystals of cholesterine are one of the most common elements of cancer. I have also seen prismatic needles in cancerous deposits; also, mineral concretions, amorphous or bone-like, yet without the structure of bone.

"All the forms of cancer present the evidences of vascularity.

"The colloid or jelly-like cancer is as well recognized a form of the disease as scirrhus or encephaloid. The cancerous tissue, especially the encephaloid, sometimes constitutes the base of the tumor, and then the cancer globules are only found in the deeper portions. In this case the gelatinous matter does not contain the true elements of cancer. We find a network of fibres forming large areolæ, and filled by a transparent matter, containing pale granular globules. This colloid matter does not appear to be different from that noticed as the product of inflammation, or as the contents of various kinds of benignant tumors. It only differs from it by being combined with encephaloid. But, in other cases, these areolæ are filled by large cells or semi-transparent lobules, which contain numerous cancer globules and nuclei.

CHAPTER XIII.

MELANOSIS.

The term melanosis, is derived from the Greek word μελας, signifying black. It is a disease in which there is the deposit of a dark unorganized substance in some portion or portions of the system. As exhibited in the solid tissues, the deposit commonly has a viscous appearance, strikingly resembling the vitreous humor of the eye, and is, in color, very much like the pigmentum nigrum. It has no smell nor taste. It is soluble in water; and, when dissolved, will stain like Indian ink. There are, however, different shades of color,—it sometimes exhibiting a brown and sometimes even a yellowish hue.

Hard melanotic deposits, unlike tubercle and scirrhus, do not

soften down at any stage of their existence. Sometimes, from the part where the deposit exists, a dark-colored fungus will arise, resembling fungus hæmatodes, and probably being of essentially the same nature. On the other hand, where carcinoma previously exists,—especially the encephaloid variety,—a melanotic deposit not unfrequently takes place. Sometimes absorbent glands,—enlarged as in scrofulous disease,—become blackened by a deposition of melanotic matter. In such cases, of course, the substance of the tumor is mainly organized structure,—the melanosis doing little more than give the coloring.

Sometimes, as is the case with scirrhus, we have melanotic tubera. occurring as a secondary form of the disease, and appearing simultaneously in various parts of the system. Indeed, scarcely any organ or tissue is exempt from liability to be affected by it. The lungs, the pleura, the heart, the pericardium, the liver, the spleen, the uterus, the ovaria, the bladder, the peritoneum, the alimentary canal, the areolar and mucous tissues generally, the muscles, the skin, and even the bones are subject to the affection. So, also, are false membranes, or the depositions of organized lymph, which take place upon previously inflamed serous membranes.

Occasionally, melanotic matter appears in a fluid form. In this case, a cyst is filled with a dark liquid, which, in its general features, precisely resembles the solid deposits. It seems, however, to be originally fluid, and not the result of a converted solid.

That, in this disease, the blood itself is impregnated with particles of melanotic matter, which really give rise to the formations in the solid tissues, is evident; and, not unfrequently, it is easy to detect these particles, by a chemical analysis.

The discovery of melanosis, as a disease, is claimed by Dupuytren. It was, however, first described by Laennec. He represented it as existing under the following four forms.

1st, Masses enclosed in cysts.
2d, Masses without cysts.
3d, Infiltration of the tissue of organs.
4th, Deposition on the surface of organs.

This division, it is clear, presents the leading distinctive features of the disease. Dr. Carswell, however, has suggested another arrangement more comprehensive and various, as follows.

Origin,—A modification of secretion.
Locality,—1st, Tissues, systems, and organs;
a, In the substance and on the surface of organs,
b, In the cavities of hollow organs.
2d, New formations.
Form,—1st, Punctiform,
2d, Tuberiform,
3d, Stratiform,
4th, Liquiform.
Seat,—1st, Molecular structure of organs,
2d, The blood.

As there are other morbid states of the system and products presenting distinctive characters, similar to those of melanosis, Dr. Carswell has also given us a tabular view of what he calls *spurious* melanosis, in distinction from the *true*. The following is his arrangement.

Origin,—A, Introduction of carbonaceous matter,
B, Action of chemical agents,
C, Stagnation of the blood.
Locality,—Of the first kind, the lungs.
Of the second kind, the digestive organs, the surface of serous and mucous membranes, the cavities of hollow organs, new formations.
Form,—Of the first kind, uniform.
Of the second kind, 1st, punctiform, 2d, ramiform, 3d, stratiform, 4th, liquiform.
Of the third kind, 1st, punctiform, 2d, ramiform.
Seat,—1st, The blood, contained in its proper vessels, or effused,
2d, Pulmonary tissue, cellular, and membranous.*

Persons, suffering this affection, sometimes discharge a dark and almost black secretion from the intestines, the stomach, and even the cystis. Under these circumstances, the old authors termed the disease melœna—the black disease. The morbid secretions, in all these cases, are evidently melanotic; and, aside from the natural secretions with which they are mixed, are scentless and tasteless.

*See Cyclopedia of Practical Medicine, Volume 2d, Page 86th.

The pathology of this disease is not yet, it is true, fully understood. The melanotic discharge, however, so far as it has been analyzed, is found to contain the important elements of the blood, —fibrine, albumen, &c.; but, in addition, nearly one third of the quantity is a highly carbonized and abnormal substance.

That the disease is one producing general and decided debility will readily be inferred from the few hints given above, respecting its pathology. The depraved condition of the blood, of course, renders it, at best, an inadequate stimulant to the nervous system; but, especially, when the alvine and other discharges are melanotic, the nutrient and stimulating portions of the blood are abnormally removed, in such quantities, as greatly to exhaust the vital powers.

In conclusion, I will only add, that various new formations, such as tubercle, carcinoma, and melanosis, may exist simultaneously in the body and in the same organ; yet each is as distinct in its nature, as are the influences by which one organ is atrophied another hypertrophied, one indurated another softened, at the same time.

CHAPTER XIV.

NON-MALIGNANT TUMORS.

Tumors in general differ from hypertrophy and euplastic deposits in the peculiarity of their structure, or their *kind* of vitality. They differ from cacoplastic and aplastic deposits in their possessing a higher degree of organization, that is, their *degree* of vitality. They are new structures; though some of them, in general characters, and most of them, in elementary composition, have a resemblance to healthy textures.

Tumors may be divided into *malignant* and *non-malignant.* The various forms of carcinoma, already generally considered, constitute essentially the class of malignant tumors. The non-malignant may be sub-divided into different classes, though it is difficult or impossible to draw a clear line of demarcation between some of these classes.

NON-MALIGNANT TUMORS are, in general, those growths which occur in any part of the body without tending to infect other parts,—which, though arising among, yet do not invade the healthy structures, and which prove injurious only by their bulk, their position, or their obstruction of the nourishment of the body. The principal portion of them may be included in one or the other of two classes.

The first of these classes is that of *common encysted tumors.* These tumors consist of a shut sac, containing either a liquid or a solid substance. The sac is formed so as to appear like areolar tissue condensed, or like serous or fibrous tissue. The liquid contents may be serum, blood, or pus, or a mixture of different ingredients. The solid contents may be either adipose, or fibrous, or sarcomatous, or cartilaginous matter; or they, too, may be of a mixed character, and may possess various kinds of structure. The solid contents, and the sacs of the tumors in the cases of both the solid and the liquid contents, are formed by altered vital properties in the cells, or primary granules, or some of the molecules of the textures, in some state of their progression. These molecules grow in modes more or less peculiar, and under influences more or less independent of the adjoining healthy parts.

The second of the two classes of non-malignant tumors referred to is that of *hydatids.* These, in character, approximate malignant tumors, in some respects. They are quite detached from healthy tissues, and are, perhaps, more peculiar, in structure and contents, than any other morbid growths. They seem to possess a vitality, in themselves and independent of the parts with which they are physically connected. That vitality, it is true, is of a low grade, but is real. They have a power of self-nutrition, manifest in the growth and structure of their walls;—a power of secretion, shown by the peculiarity of their limpid and colorless contents; and a power of reproduction by gemmation, the young being developed between the layers of the parent cyst, and thrown off, either internally or externally, according to the species. According to Professor Owen, the hydatid is "an organized being, consisting of a globular bag, which is composed of condensed albuminous matter, of a laminated texture, and containing a limpid colorless fluid, with a little albuminous, and a greater propor-

tion of gelatinous substance." Whether, however, it is an animal or a vegetable, the Professor is slow to decide. But, surely, it can scarcely be considered an animal, as it neither feels nor moves. It has no contractile power, and is impassive under the application of stimuli. It evidently has nothing but organic or vegetable life; and it grows in the system, as the plant grows in the earth. It is, however, a nucleated cell, from the interior of which are developed nuclei and nucleoli, the germs of young cells; and, whether animal or vegetable, it would seem, that it must be, in its origin, an offset from healthy structure. Certain molecules, in a way not understood, must, at first, assume this abnormal form and detached life.

Hydatids are found in the lungs, liver, spleen, kidneys, uterus, and even in the mammæ. Their serous or protective cysts are formed much like those of common encysted tumors. Their existence supposes a state of cachexia or mal-nutrition in the system. They injure the system and destroy the health, by their bulk and position, by their compressing, displacing, and irritating some of the organs, and by the atrophy and inflammation of textures which they cause. Their cysts contain laminated matter more or less opaque, which is evidently the debris of collapsed hydatids; and, with this, sometimes a quantity of yellowish, opaque, pultaceous matter, consisting of granules, imperfect cells, fat, and other substances, deposited from the surface of the sac and degenerated so as to be aplastic.

Among non-malignant tumors have, also, been reckoned those which are vascular or erectile. These consist of a congeries of blood-vessels of considerable size, apparently enlarged capillaries, with more or less connecting filamentous tissue. Their structure, however, or their kind of vitality does not seem to be materially different from that of euplastic deposits. When they are supplied by large arteries, they are florid in color and pulsate, and, if themselves large, give a bellows or rasping sound with the pulsation, like what is heard in bronchocele or goitre. When the arterial communication is not free, they exhibit the darker hue of venous blood.

There are various other modifications of non-malignant tumors, the consideration of which is not necessary to my present purpose.

DIVISION II.

DIAGNOSIS.

Diagnosis is originally a Greek term, διαγνωσις, signifying the art of distinguishing or discerning. Medically applied, however, it imports either a discriminating acquaintance with disease, or the science which gives that acquaintance.

As a science, diagnosis teaches the various methods of detecting existing pathological conditions. In other words, it illustrates the phenomena attendant on the different forms of disease. These phenomena may be general in their character, or special; they may be constitutional or local; they may disclose themselves only to the patient, or they may be manifest to the senses of another.

In what follows, I shall attempt an explanation of such topics as are important in understanding the nature of diseases, and yet are liable to fail of being accurately comprehended. My remarks will apply mainly to diseases of the thorax, though I shall develop the principles of physical diagnosis, in their application generally.

CHAPTER I.

SYMPTOMS.

The symptoms by which the knowledge of disease is gained, may be divided into *rational* and *physical symptoms.*

According to this division, the *rational symptoms* embrace those which we learn through the medium of the patient's mind. Thus, pain or any peculiar sensation, and its locality, are made known to us by the intellectual and communicating faculties of the patient. The *physical symptoms*, on the contrary, reveal themselves to us, through our own physical senses. By the eye, for instance, we perceive the form and the countenance of dis-

ease. By the ear, we take cognizance of a diseased action of the heart and lungs, as, also, of many changed conditions of the structure of those organs. By the touch, we learn the character of the pulse, the consistency of the tissues, and the position and relation of various organs. The sense of smell alone will often decide the character of a disease, as in the case of cancerous and febrile affections. Even the taste has sometimes been employed upon the excretions, to detect the existing malady.

This division, though simple, is of but little practical utility; and, hence, different classifications have been suggested.

In reference to pulmonary diseases, Dr. John A. Swett of New York, adopts the following division of symptoms.

"The *constitutional symptoms*,—which are the changes produced by these diseases, in the general system and in remote organs:

"The *rational symptoms*,—which are the changes produced, by a perversion of the healthy functions, or of the physiological action of the lungs:

"And, finally, the *physical signs*,—which are produced by physical changes in the structure and condition of these organs."

According to this division, the furred tongue, the excited pulse, and the hot skin produced by pneumonitis, for instance, are *constitutional symptoms*. The cough, the expectoration, and the dyspnœa are *rational symptoms;* while the dulness on percussion, the shrill bronchial sound in respiration, and the like evidences of the disease are *physical signs*. This distinction, we may, if we choose, apply to the indications of other diseases, as well as those of the lungs.

Sometimes, symptoms have been divided into *general* and *physical*. When this division is employed, the phrase *general symptoms* is intended to embrace what Dr. Swett would include under the two heads of *constitutional* and *rational*.

A better division is into *general symptoms* and *special*. The former class embraces phenomena which respect the constitution generally, or parts remote from the immediate seat of the disease. The latter includes the indications which arise more directly from the part affected, or what Dr. Swett would place in the two classes of *rational symptoms* and *physical*.

Sometimes, and with much propriety, a technical distinction is made between *symptoms* and *signs*. According to this distinction, *symptoms* are the existing phenomena, as they appear to all, without revealing any condition of things as their cause. These same phenomena become *signs*, when they are understood to indicate some particular state of the system. Thus a certain crackling sound, proceeding from the thorax, gives, to the uninstructed man, no important information whatever. He knows not of what disease it is indicative, or whether, even, it may not accompany a state of health. It is, *to him*, a mere *symptom*. *To the intelligent physician*, however, it is something more. It speaks the existence of incipient pneumonitis, and is, therefore, called a *sign* of that disease.

Several symptoms, existing together, may render certain the existence of a particular disease, though any one of them, by itself considered, gives but a doubtful indication. Such a *collection* of symptoms is called a *diagnostic sign*. By comparing present symptoms with those which have preceded, at different times, we judge of the prospect for the future, and, thereby, make the *succession* a *prognostic sign*. A *pathognomonic sign* is one which attends but a *single condition* of things, and, therefore, makes that condition *absolutely certain*.

In general, however, without an accurate regard to such distinctions as the above, we apply the terms, *physical symptoms* and *physical signs*, rather indiscriminately, to those indications of disease which are embraced in *auscultation*, *percussion*, and their kindred means of diagnosis.

CHAPTER II.

TOPOGRAPHICAL TERMS.

To assist in describing the physical examination of a patient, it is convenient to have certain topographical terms, marking different superficial portions of the thorax.

For this purpose, we may divide the anterior portion into three parts, on each side of the sternum. The superior, extending

from the summit of the lungs to the top of the third rib, is the *right* and the *left superior third.* This region, on each side, which may be called the *supra-mammary*, is important; and, for further convenience, may be sub-divided into the *post-clavicular* space, or that partially behind and partially above the clavicle;—the *clavicular*, corresponding to the clavicle;—and the *sub-clavicular*, beneath the clavicle. The *middle third*, on each side, which may be called the *mammary* region, may be made to extend from the top of the third rib to the top of the sixth. The *inferior third*, on each side, will, of course, extend from the top of the sixth rib to the inferior margin of the thorax. This may be called the *infra-mammary* region. Sometimes, too, we give, to certain localities of the anterior portion of the thorax, other names according to anatomical relations, as the *præcordial* region, the *sternal* region, &c.

The posterior portion of the thorax may be divided into thirds, the superior extending from the top of the shoulders to a line drawn horizontally over the spine of the scapulæ. This may be called the *superior dorsal* region. The second third may be called the *middle dorsal* region. It extends, from the lower margin of the superior third, to another horizontal line drawn so as to touch the inferior angles of the scapulæ. This may be called the *inferior dorsal* region. Each of these three regions may be sub-divided, by the spine of the back, into the *right* and the *left* parts of the regions severally. Here, likewise, we sometimes derive, from anatomical parts, other terms to designate particular localities; and we speak of the *scapular* regions, the *intra-scapular*, the *dorsal*, &c.

The spaces in the axillæ and above the fourth rib on each side may be called the *axillary regions.* The lateral spaces beneath these, extending downward to the seventh ribs, may be called the *lateral* regions. And, sometimes, the narrow spaces at the very tops of the shoulders, extending from the acromion processes to the neck are called the humeral regions.

In like manner, for examining the abdomen (including the pelvis), we have a topography sufficiently accurate, in the following delineation. Suppose a line, drawn horizontally around the body, so as to touch the extremity of the ensiform cartilage. This

will define, near enough for practical purposes, the superior boundary of the abdomen. Suppose a second line, drawn parallel to the first and touching the lowest portion of the last false ribs. Between these two lines, we have a zone or belt across the abdomen. Suppose, now, a third line, drawn parallel to the former two and touching the crest of each ilium. Between this and the second, we have a second zone; and, below this, we have a third zone. Suppose, now, we raise a line, vertically, on each side of the abdomen, from the anterior spinous process of the ilium, so as to cut the horizontal lines at right angles. This will divide each zone into three regions. The middle region of the superior zone may be called the *epigastric;* and those on each side the *right* and the *left hypochondriac.* The middle region of the middle zone may be called the *umbilical;* and those on each side the *right* and the *left iliac.* The middle region of the lowest zone may be called the *hypogastric;* and those on each side the inguinal. Sometimes, terms designating particular parts of the superficies of this cavity are suggested by other anatomical considerations, or by the position of certain viscera within. Hence, we speak of the pubic region, the hepatic, the gastric, &c.

CHAPTER III.

THE POSITION OF THE PATIENT.

For interpreting the constitutional and rational symptoms generally no specific rules need be given; but, to be taught correctly by physical signs, various directions must be carefully observed. Such of these as relate to the position of the patient I will now briefly point out.

For succussion, the upright posture is mostly, though not always, required. For palpation, both the upright and the recumbent posture are necessary in different cases, and, sometimes, in the same case. Abdominal and pelvic examinations mainly demand the recumbent posture, and generally a dorsal decubitus,—sometimes, however, one partly lateral. Inspection and mensuration usually require, each, the upright posture; though, from the re-

cumbent, with dorsal decubitus, some information may be gained.

For percussion, the proper position of the patient varies according to the relation and circumstances of the part to be examined. In abdominal examinations, the recumbent posture is generally needed, and almost always dorsal decubitus. In thoracic examinations, however, the case is different. Ordinarily, the upright posture, but sometimes the recumbent, and sometimes both in connexion are required. When the upright posture is to be assumed, if the patient is well able to leave his bed, I choose to have him seated in a convenient chair. Let the muscles of his chest be put somewhat upon the stretch, and the skin be rather closely drawn, so as to render the parietes as tense and elastic as convenient.

When the percussion is anterior, the shoulders should be thrown slightly backwards, so as to give a little tension to the pectoral muscles; and the arms should hang easily by the sides, or the hands be laid forward upon the thighs. In posterior percussion, on the contrary, the patient should lean forward, and firmly clasp his arms in front. The dorsal and cervical vertebræ thus forming a curve, the scapulæ will be drawn away from the spine, and the muscles of the back will be rendered suitably tense. To percuss either axilla, let the arms be raised, and the palms of the hands rest lightly on the top of the head.

If, however, the feebleness of the patient forbids his being seated in a chair, he may sit upright in his bed; or, if too feeble for that, he may be percussed with accuracy, while recumbent. For anterior percussion, let him lie evenly upon his back, with his head and shoulders but slightly raised, and with no such elevation or depression of any portion of the body as shall vary the symmetry of his form. For posterior percussion, he may be turned upon his face and abdomen. For axillary percussion, he may lie partially on the opposite side.

For auscultation, essentially the same rules are to be observed, in regard to the position of the patient, as have been given for observance in percussion. Less attention, however, needs be paid to the tension of the muscles and the skin; as, in the suitable application of the ear to hear, this object will be sufficiently accomplished. When the strength of the patient does not allow

of his assuming the erect posture, he may be ausculted, with sufficient accuracy, in bed. Let his position, when necessary, be varied from dorsal decubitus to lateral, and even abdominal and facial. When his prostration by disease is considerable, the symptoms recognized from the anterior part of the thorax will usually be found decisive; and, consequently, the dorsal decubitus only will be necessary.

CHAPTER IV.

SUCCUSSION.

Of all the means of physical diagnosis, this is of the least importance. The term signifies a shaking; and the act consists in suddenly agitating a patient with the view of detecting the existence of a fluid in some one of the cavities of the body,—particularly, one of the pleural sacs. Seizing, by the shoulders, an individual, as he is ordinarily seated, strongly jolt or shock his whole frame. In this way, the sound of a contained fluid may sometimes be heard, like that of a liquid in a cask or bottle that is forcibly agitated. This has been called the metalic splash. Sometimes, the patient in bed is able so to shake himself as to give the *splashing* sound of the water, in the thorax. Even water in the pericardium has occasionally been, by succussion, detected. The art was known to Hippocrates, and has, hence, sometimes been termed Hippocratic succussion.

There is, however, but little occasion to employ this method of detecting the existence of water in a cavity, as ordinarily it is made perfectly evident by other means of diagnosis.

CHAPTER V.

PALPATION.

The matter of palpation is of a little more practical utility than succussion. The term signifies feeling or handling; and the act consists in the application of the hand or fingers to the part to be examined. Thus, if, while a person is speaking, the hand be ap-

plied to the parieties of the thorax, a tremor will ordinarily be felt; and the character of this will vary according to the condition of the viscera immediately within. If no tremor appears, that negative circumstance has a language of its own. The enlargement of an internal organ, as the liver, the existence of a tumor or of an aneurism, an abnormal action of the heart, and the fluctuation of the liquid in some forms of dropsy may sometimes be detected by the hand.

Palpation, however, like succussion, is, at present, but little used; as, in most cases, we have surer and better means of diagnosis.

CHAPTER VI.

INSPECTION.

Rising a little higher in the scale of importance, we come to the subject of inspection. This consists in an ocular survey of the patient, for the purpose of judging, by some recognized want of symmetry, or other abnormal condition if it exists, in what manner and to what extent, there is a departure from health.

To apply, with effect, to the chest, this means of diagnosis, the clothing of that portion of the body, must be entirely removed, and the attitude of the patient must be such as not unnaturally to vary the relation of those parts which, in health, should be found symmetrical. In this condition, any considerable lack of symmetry is easily detected by the eye. So, also, are many such prominences and depressions as are created by disease, whether they destroy the relation which one part of the body bears to the other, or not. Of this nature, are the fulness of the precordial region, the enlargement or contraction of one of the sides, the elevation or depression of one of the shoulders, the contraction about the clavicles increasing their apparent prominence, and like variations from the standard of health. The phenomena, thus inspected, become signs of the disease existing within. So, also, do certain abnormal motions of the chest, neck, or abdomen, occurring in respiration or with the impulses of the heart. Even the absence of the proper movement may indicate disease; and this absence may be made known by inspection.

CHAPTER VII.

MENSURATION.

As an aid to inspection, and as a matter not far from tantamount in importanee, is mensuration. This consists in the admeasurement of certain parts whose form is altered by disease, and in the comparison of that admeasurement with the standard of health. Passing a tape or measuring line around the thorax, we may, by means of it, learn very aeeurately the comparative fulness of the two sides. We may, also, by comparing the eireumferenee at the superior with that at the inferior portion of the thorax, decide whether the relation of those portions is consistent with the condition of health. By mensuration, too, we may determine the position of the nipples with referenee to the sternum, to the elavicles, and to the spinous processes of the ilia; and, by so doing, may gain diagnostie signs of eertain diseases.

CHAPTER VIII.

PERCUSSION.

None of the previously eonsidered means of diagnosis compare, at all favorably in importance, with percussion. By this is meant the method of deteeting the condition of internal organs, from the eharaeter of the sound produced, when the surfaee of the body directly over those organs reeeives the foree of a light blow. It was invented by Avenbrugger.

The sounds produeed by pereussion are divided, generally, into two,—the resonant and the dull.

The resonant sound is heard on pereussion over a spaee filled with air or gas, usually termed an empty spaee.

The dull sound is heard on percussion over a solid or a liquid substanee.

The former of these sounds is illustrated in the case of striking upon an empty barrel or eask;—the latter, by the same aet, when the barrel or cask is filled with liquid. Or we have a modified il-

lustration in the case of a barrel partially filled with liquid. Strike upon that barrel above the surface of the liquid, and you hear a hollow or resonant sound. Strike below the surface, and you hear a dull or a flat sound.

In percussing over any of the cavities of the human body, if no internal viscus lies near the paries or wall, we have a *very resonant* sound. If the cavity is filled partly with air or gas, and partly with solid viscera intermixed, or if there be within a viscus of a spongy character, we have a less *resonant* sound. If a solid of medium density lies within, we have a slightly *dull* sound. If a very dense solid or a liquid within receives the force of the percussion, we have a *very dull,* often called a *flat sound.* Hence we speak of very resonant, resonant, dull, and very dull or flat sounds. We even use other qualifying terms to mark nicer differences, according to circumstances, as the ear is able to distinguish those differences.

There is, however, one peculiarity of sound, or one adventitious sound of percussion, which deserves a moment's special consideration. It is usually called the cracked-pot sound,—in French, *bruit de pot fêlé.* The name sufficiently explains itself. It is a kind of cracking or chinking sound. It may be imperfectly imitated, by clasping the hands together, in such a manner, that the palmar surfaces shall constitute the walls of a small cavity, and then striking the dorsal portion of one of the hands on the knee or some solid substance.

The sound is heard when percussing over a cavity, with thin walls; as, for example, over a tuberculous cavity near the surface of the lung, when the pulmonary and costal portions of the pleura are united at the part concerned. It may be heard, when a disease of the lung draws a portion of it away from the thoracic wall, so as to leave a hollow space.

Percussion is either *immediate* or *mediate.* Immediate percussion supposes the blow to be made immediately upon the body of the patient,—no substance intervening. Mediate percussion, on the contrary, supposes some substance interposed or placed on the part to be percussed, primarily to receive the impulse and to communicate it to the body beneath.

Immediate percussion was the form in which the art was first

practiced. By it, Avenbrugger threw much new light on the nature of many diseases; and, shortly after, Corvisart, adopting and advocating it, contributed much to establish its reputation. As thus practiced, however, the art was imperfect.

At length, M. Piorry, physician to the Hotel Dieu of Paris, invented mediate percussion, and applied it, with greater success, to the investigation of the nature of diseases; and now the increased advantages and accuracy of the latter mode have caused it entirely to supercede the former. In mediate percussion, as at first employed, a dense body, of a small superficial extent, was placed in contact with that portion of the patient to be percussed; and was made to receive an impulse from the fingers or some artificial percussor, used after the manner of a small mallet. This body took the name pleximeter, or, as it has been sometimes written, plessimeter, signifying a measure or measurer of percussion.

The object of the pleximeter is to gather the sound from some little extent of surface, and thereby produce a stronger impression upon the ear. Besides, if the patient be thin in flesh and very sensitive, immediate percussion will give him uneasiness, and will be too impatiently borne for its practical advantages; or, on the other hand, if there be a rather abundant amount of adipose tissue, or if the areolar tissue be somewhat infiltrated with serum, the condition of the internal organs will not be truly represented.

The pleximeters in earliest use were made of metal and ivory. Afterwards, leather and other substances were tried; and, of late years, a square piece of caoutchouc, about one fourth or one third of an inch in thickness, and about two inches in diameter, has been recommended. This, which was first proposed by Dr. J. B. S. Jackson of Boston, Mass., has an advantage over the materials which are more solid and scarcely elastic, in its power of accommodation to any unevenness of surface, and the transmission thereby of a greater volume of sound. By being, too, of a density nearly similar to that of the tissues over which it is placed, it represents more truly the quality of sound created by the condition of the organs and space within. A hard unyielding substance necessarily gives some degree of sharpness even to sounds which would otherwise be measurably resonant; and, besides, if the instrument shall happen not to be applied with sufficient firmness

and care, the true sound is liable to be masked by a clack of the air beneath. To do justice to the quality of sound, the plexímeter should gently compress and measurably displace any tissues adapted to prevent the natural vibrations of the part percussed.

In accomplishing this end, nothing is found to answer so well as one of the fingers. For convenience, we take either the index or the middle finger of the left hand. This is easily adapted to any irregularities of the surface to which it is applied, and is, in every respect, decidedly superior to any artificial instrument that human ingenuity can invent.

Ordinarily, the palmar surface of the finger should be presented to the body of the patient, and the percussion should be made on the dorsal surface. The reason of this direction is, the softer portion of the finger best adapts itself and covers the part from which we wish to gather the sound; while the harder portion, by means of its density, best conveys and represents the sound to the ear. In some conditions, however, it is convenient and desirable to reverse the finger. By its natural curve, for instance, it better fits certain depressions, as those above or behind the clavicle, some places between the ribs, and other parts; and the advantage gained in the matter of adaptation may more than counterbalance any consequent defect in the communication of the sound.

In percussing certain symmetrical portions of the body—of the chest particularly—,when we wish to compare one sound with the other, a caution or two must be observed;—Do not make one of the above-named applications of the finger to one part, and the other to the other part. It may prevent a discriminating comparison of the sounds. Be careful, also, to press the finger equally firm, and to apply it in analogous directions, in both instances, as well as on analogous portions. In comparing the two sides of the chest, for instance, we must percuss at equal distances from the sternum, and in corresponding intercostal spaces or over corresponding ribs.

For the purpose of giving the blow in percussion, an instrument has been contrived by Dr. Jacob Bigelow of Boston, Mass. It consists of a handle, about six inches in length, made of whalebone or tough but slightly elastic wood, to one extremity of which is attached a ball, about an inch in diameter. This ball is made in-

ternally of some solid substance, and covered pretty thickly with velvet or buckskin, so as to be externally quite elastic. Besides, however, the trouble of preparing it and keeping it by one for use, it muffles the sound, and forbids an accurate discrimination.

Incomparably the best percussor every one has received as the boon of nature. It is found in the right hand simply. Of this, we may use directly one or both of the index and middle fingers; or with these two we may unite, also, the ring finger, taking care to place them so that their extremities shall form a line, and all be equally impressed on the finger of the left hand used as a pleximeter. The phalanges should be so arranged that the third set shall form nearly a right angle with the first, and constitute the head, so to say, of a light mallet or hammer. In that position they must be firmly retained. Of course, the blow brings only the extremities of the fingers in contact with the pleximeter.

The act of percussion should be performed, as far as possible, without any motion of the arm, or even of the forearm. The wrist becomes the moveable point or hinge, and the metacarpus the handle of the percussor. By using any portion of the arm, we almost necessarily strike a blow too firm for the convenience of the patient or for delicacy of sound. We almost necessarily, too, allow the contact to exist for a moment instead of instantly withdrawing the fingers. The consequence is, we prevent the proper vibration of the parts concerned, and thereby obscure the sound. When motion is made from the wrist only, it is much more easy to give suddenness to the impulsion, and thus to favor the reaction of elasticity.

When percussing over thick adipose tissue or tissue infiltrated with serum, we must necessarily use more force than is desirable where the parietes are thin and the internal organs delicately sensitive. In such a case, we should not fail to employ together, the three fingers before named; but we must be particularly careful to have them suddenly rebound after the blow. It is the quickness, rather than the force of the impulsion, which gives the proper clearness and sharpness to the sound. On the contrary, when we are concerned with tissues unusually thin,—when, for instance, we are percussing the chests of children, or of persons greatly

emaciated, the degree of elacticity is such as to render preferable the use of but a single finger.

Percussion is extensively applicable in detecting the condition of organs both in the thorax and in the abdomen. Its importance, however, is much greater, in the former case than in the latter.

The degree of resonance or dulness is different in different portions of the body, while in health. In the abdomen, the alimentary canal is ordinarily distended partly with gaseous substances; and, hence, percussion directly over this canal gives considerable resonance. On the other hand, over the solid viscera,—over the liver, for instance,—we get a degree of dulness.

In the thorax, the resonance, *cæteris paribus*, is greatest over those portions of the lungs, in which the vesicles and smallest bronchial tubes are most numerous, because the thin parietes of those cells and tubes favor the vibration of air within them; while, on the other hand, the thick and rigid walls of the large bronchial tubes allow of comparatively little vibration, and render, in percussion, a degree of dulness. The sound, however, is very much modified by the character of the parietes of that part of the thorax on which we percuss. Thickness of muscular, adipose, or osseous substance creates dulness. The heart is a substance much more solid than the lungs. Hence percussion on the præcordia gives a duller sound than over any portion of the lungs.

In general, the resonance, the thoracic viscera being normal, is greatest in the axillæ, on the sides, along the lower part of the anterior margin of the chest, and below the scapulæ, posteriorly; while, at the summit and at the root of the lungs, the sound is comparatively dull. Where a portion of the left lung overlaps the heart, the sound, of course, is intermediate between the natural dulness at the centre of the præcordia, and the resonance where the vesicles are most abundant.

In judging whether there is disease of any viscus, we compare, in our minds, the sounds heard with such as we believe health ought to render. Where, too, there are analogous parts, we directly compare the sound of one part with that of the other.

CHAPTER IX.

AUSCULTATION.

The most important of all the means of physical diagnosis is auscultation. By this is meant the art of detecting the condition of internal organs by means of the sounds produced by vital internal movements. It was invented by Laennec. Any organ, which, in either of the grand cavities of the body, yields a sound, when the purposes of the vital economy are being fulfilled, may be examined by auscultation; and, by the existence and the quality of the sound, knowledge is often gained respecting the healthy or the diseased condition of that organ.

In regard to the abdomen, however, this art is of less practical value than percussion. The sound of the fœtal heart in an advanced state of pregnancy may be recognized by auscultation. So, too, may a peculiar thrill of the larger arteries; and certain intestinal movements in the abdomen give evidence of peculiar internal conditions. But it is to the viscera of the thorax that it principally applies. By it various conditions of the lungs and of the heart are determined with much accuracy. These, in subsequent pages, are to be made the subject of careful and extended remarks.

Section I.

THE MODE OF APPLYING AUSCULTATION.

Auscultation is either *mediate* or *immediate*. Mediate auscultation supposes, for the purpose of conveying the sound, the intervention of a tube between the part of the patient to be auscultated and the ear of the auscultator. Immediate auscultation, on the contrary, supposes the ear to be applied directly to the part to be examined.

Laennec employed mediate auscultation. Having, accidentally, in a sense, rolled a piece of paper into the form of a cylinder and applied it to the chest of a person whose heart was diseased, he

was struck with the distinctness of the cardiac sound; and this gave origin to the systematic use of an acoustic instrument, which took the name stethoscope, from its being primarily and principally applied to examinations of thoracic viscera.

Since the first adoption of mediate percussion, stethoscopes of various materials and various forms have been employed. The kind of instrument originally used by Laennec was crude and unwieldly, and, with great propriety, has been laid entirely aside.

The sounds to be communicated to the ear are variously created, and require a somewhat peculiar instrument of conduction. Those originating in solids are best transmitted by a solid; and those originating in air are best transmitted by air. Indeed, the more nearly the conducting substance agrees, in density and structure, with that giving origin to the sound, the better is the sound conducted.

For a stethoscope, then, we want a substance which will convey sounds such as are generated by the solids within the cavities of the human body, particularly those within the thorax. This purpose may be tolerably well secured by any one of several different kinds of material; but by no one better, perhaps, than by some wood, of a light kind but having firm longitudinal fibres. Cedar, hard pine, mahogany, &c., answer very well; but none is better than the first-named.

But several of the most important sounds to be regarded in auscultation, are made in air, and therefore require an aerial conductor; that is, they must be conveyed through a column of air. To secure this object, a cylinder is perforated from one extremity to the other so as to give a calibre of about one fourth of an inch in diameter. The column of air rising in this will conduct aerial sounds, such as those created in the thorax, by the respiration, the voice, and the cough.

One extremity, however, of a calibre of the above-named size can come in contact, at any one time, with only a very small spot of surface, and, consequently, can successfully transmit those sounds only which are produced at or near that point of contact. This limitation, on condition that the sound is distinctly audible, secures an advantage in not allowing different sounds from an extended space to reach the ear simultaneously. For ordinary

purposes, however, such a cylinder would be very imperfectly adapted. Beside increasing the labor of examining a surface of any extent, there cannot be received into such a calibre a sufficiency of vibrations to render the sound sufficiently audible.

To remedy this inconvenience, the calibre of the instrument is increased at its basal extremity, so as to take a conical or funnel-shaped form,—the opening or mouth being one inch or more in diameter. By this arrangement, all the vibrations beneath the whole surface covered by the base of the cone are concentrated, and thereby so conducted as far more forcibly to impress the ear. The sounds, too, are further increased in power by their reflection from the walls of the instrument, whose conical relations, give to the vibrations an onward direction, or one forming a less angle with the central axis. Now, though metals, glass, porcelain, &c. will reflect aerial sounds even better than any forms of wood, yet such materials are too dense to receive those vibrations which originate in the solids under examination, and are, for that reason, undesirable. There is even another advantage derivable from the use of light but rigid wood in forming the stethoscope. As, on the one hand, by its comparative rigidity, it will receive the finest vibrations from denser substances, and yet, by its comparative lightness, will give extent to these vibrations and cause them to impress a greater amount of air; so, on the other, it will receive the rarer vibrations from air, condense them, and transmit them to a more solid substance, or to the ear. Hence, it will tolerably well transmit any strong vibrations which fall upon the walls, too perpendicularly to be reflected much onward; and thus sounds are so transmitted, by the walls of the tube and by the contained column of air, that a tinkling echo, which would otherwise mask the original character, is avoided.

To complete the acoustic instrument, it should be furnished, at the extremity which is at or above the apex of the cone, with an ear-piece essentially flat and of such size as to adapt itself well to the auscultator's ear, varying somewhat, of course, according to the shape and size of that ear. Or he may have the extremity form a nipple-shaped projection; and, by inserting that directly into the organ of hearing, thus secure the whole sound. A proper length for the cylinder is about six inches. It should not be

so short as to endanger a reception of sound passing to the ear without the instrument, nor yet so long as very much to diminish the intensity of the sound which it transmits.

A stethoscope, consisting of a flexible tube about two feet in length, and having a calibre of the ordinary size, has sometimes been employed. This, like the one in more common use, is furnished, at one extremity, with a funnel-shaped opening, and, at the other, with an ear-piece. It was first introduced, by Dr. Pennock of Philadelphia, for the purpose, more particularly, of examining the sounds of the heart; because it would convey the vibrations to the ear, without giving an impression of the impulsion against the walls of the thorax. I have frequently employed it, with good effect, in ausculting, not only the heart, but the lungs. It affords one advantage in the examination of a person who is too feeble to be raised into the upright posture. You may sit or stand by his bed, and the length of the instrument will enable you to make any wished-for application.

One other kind of stethoscope remains to be considered. It has been introduced by doctors Camman and Clark of New York, specially for auscultatory percussion. This instrument consists of a cylinder, not perforated, made of cedar or some similar kind of wood, about six inches in length, and three fourths of an inch in diameter, and furnished, as usual, with an ear-piece. It is applicable to any case in which we would detect the dimensions of a solid viscus or tumor in either of the large cavities of the body. Its principal use, however, is in ascertaining the dimensions of the heart, including its investing membrane, the pericardium. Sometimes a parabolic or wedge-shaped form is given to the extremity to be applied to the patient, in order to adapt it to the intercostal depressions of the præcordia.

In auscultatory percussion, we place the solid stethoscope somewhat centrally over the organ to be examined, and apply the ear, as in other cases, supporting the instrument by the ear. We then percuss, as usual, over the organ and near its border; and, gradually moving the pleximeter, we continue the percussion, until the line of the margin is indicated by a change of sound. While percussing over any organ, as the heart, for instance, and near the stethoscope, we hear "a clear, sudden, intense sound of

a high tone;" and this is accompanied with a short abrupt impulse apparently produced directly under or within the instrument. If we strike a little remote, where the lungs overlay the heart, we have a mixed sound or one somewhat modified, but retaining in part its cardiac type. But, moving the pleximeter, by degrees, still farther, as soon as we pass entirely from over the heart, the sound suddenly changes, "losing its intensity and high tone, and being no longer impulsive, but grave and distant."

In the same manner we may explore the boundaries of the liver. The stethoscope being centrally placed, the sound produced near it will be somewhat clear and intense, and seem to be directly under the instrument, though more prolonged and reverberant than in the case of the heart. As we pass from the instrument, the sound diminishes, and is lost as soon as we get beyond the hepatic margin.

Auscultatory percussion may be applied to the spleen, the kidneys, aneurisms, and internal tumors. It is supposed, also, that, by it, fractures of bones may be detected, and that true anchylosis may be discriminated from false. Where the parts are continuous and united, "the sound and impulse are transmitted;" but, where the parts are separated, the sound and impulse scarcely appear.

That this mode of detecting disease may be made of some further utility is probable enough. Still, with the benefit of the more common means of physical diagnosis, it is hardly to be expected, that the province of auscultatory percussion will be very much extended.

Mediate auscultation and immediate have each its advantages. The advantages of the former are principally the following.—By the stethoscope, especially by one whose funnel-shaped portion is contracted, we can, with precision, determine the point from which an internal sound originates. We can accurately mark, for instance, the position of a pulmonary cavity, and can discriminate from which of the cardiac orifices a morbid sound of the heart proceeds; whereas, by the ear directly applied to the thorax, we gather the sound from so large a space, that as nice discrimination is impossible. We may hear several modifications of sound, arising from points a little remote from each other, but confusedly

mingled. There is even a liability of our mistaking tracheal respiration, conveyed to the ear by the surface of the head, for cavernous respiration in the superior lobe of the lung, over which the ear is placed. Another advantage is in the better application of the stethoscope than of the ear, to some portions of the body, as the axillæ, the spaces between the scapulæ, and the post-clavicular regions, in cases, especially, of emaciation and depression. Again, in the case of the female, modesty sometimes requires the application of the stethoscope, in ausculting the mammary region. And, still further, the immediate application of the ear to any portion of the body, when the patient is filthy, especially if freely perspiring, is not pleasant; and, if he happens to be afflicted with an infectious disorder or with certain nameless specimens of animal life, it is neither pleasant nor safe.

On the other hand, immediate auscultation is more simple, more easily adopted, and more readily learnt. If the stethoscope is employed, it must be so adjusted as to have a perfect contact with the surface to which it is applied; and the ear must be carefully adapted to the ear-piece. In immediate auscultation there is nothing of this sort to require attention. The sounds, too, appear louder, and better characterized than when the stethoscope is employed. The reason is, vibrations, in greater amount, enter the ear, being conducted to it, by the solids of the patient's body and the auscultator's head. This, in ausculting the chest of a person whose respiration is feeble, or, in any case in which the sounds lack distinctness, is of no small advantage. When the stethoscope is used, there is more danger of mistaking a rustling of the patient's clothes or other external noise, for a sound rendered through the instrument. More care, too, needs be taken in assuming an unconstrained position, and in having the part to be examined nearly or altogether divested of covering. In immediate auscultation, unless the case be one demanding niceness of discrimination, these particulars need not be as closely regarded.

Again, in a large majority of cases, the direct application of the ear is decidedly to be preferred, on account of the greater rapidity of its application. Not only is there no delay by reason of the absence of the stethoscope, but the ear can be passed much more rapidly, and yet ordinarily as successfully, over the part to

be ausculted. As we gather the sound from a considerable surface at once, we can make each successive application at a point more remote from the preceding, in passing over those parts where there is nothing abnormal or what requires special attention.

Section II.

THE HEALTHY SOUNDS OF RESPIRATION.

Healthy respiration has two elements of sound.

1st, The *tubal* or *bronchial sound.*

2d, The *vesicular sound,*—sometimes called the vesicular murmur, or vesicular respiration.

In *health,* these sounds, in inspiration, are always combined, but in different proportions. In *some diseases,* however, the former may be heard without the latter; but the latter must always be more or less modified by the former. In expiration the sound, in health, is in a good degree bronchial, being modified comparatively little by vesicular influence.

The better to illustrate the character of these sounds or elements of sound, I present, in few words, some matters connected with the anatomy of the parts concerned in their formation. The great mass of each lobe of the lungs is filled with air-cells or vesicles; but these are divided into clusters, and each cluster, with the tissues involved, is called a lobule. Each lobule is completely separated, from those by which it is surrounded, by areolar tissue.

The large bronchi or bronchial tubes, forming the bifurcation of the trachea, almost immediately enter the lungs, divide and subdivide, but without anastomosis, until they have sent branches, that is, smaller bronchi or bronchia (the latter term being sometimes employed to designate the branches of the largest tubes) to every part of the organs. There is, however, a difference in the manner in which these tubes enter the lungs. The one leading to the right lung is shorter and larger than the one leading to the left,—the latter passing behind the aorta, and necessarily taking a more tortuous course than the former.

"All the larger branches" of these tubes, in the language of

Kirkes and Paget, "have walls formed of tough membrane, with organic-muscular circular fibres, giving them some power of spontaneous contraction,—portions of cartilaginous rings, by which they are held open,—and longitudinal bundles of elastic tissue, for greater power of recoil after expansion. They are lined with mucous membrane, the surface of which is covered with vibratile ciliary epithelium. But, when the bronchi, by successive branchings, are reduced to about 1-100 of an inch in diameter, they lose these structures, and their walls are formed of only a tough, elastic membrane, with traces of fibrous, perhaps muscular structure, over which the capillaries are spread in a very dense network, and on various parts of which air-cells irregularly open. Tubes of this kind are named, by Mr. Rainey *intercellular passages.* The air-cells, opening into them, may be placed singly on their walls, like recesses from them; but more often are arranged in rows, like minute saculated tubes; so that a succession or series of cells, all opening into one another, open by a common orifice into the tube." Each lobule has one small bronchus or bronchium of its own. This terminal bronchus passes directly to the centre of the lobule, and there terminates in a slight enlargement so as to be fitly compared, on a reduced scale, to a pipe-stem with a sponge attached to it. On their way towards their termini, the bronchi, in connexion with blood-vessels, pass, in the areolar tissue, between the lobules.

"The cells are of various forms, according to the mutual pressure to which they are subject. Their walls are nearly in contact, and they vary from 1-120 to 1-1200 of an inch in diameter. Their walls are formed of fine membrane, similar to that of the intercellular passages, and continuous with it, which is folded on itself, so as to form a sharp-edged border at each circular orifice of communication between contiguous air-cells, or between the cells and the bronchial passages. The cells have no epithelial lining; but, on the exterior of the membrane of which they are constructed, a network of pulmonary capillaries is spread out so densely that the interspaces or meshes are even narrower than the vessels, which are, on an average, 1-3000 of an inch in diameter." Each terminal bronchus is surrounded by the air-cells of that lobule. Those cells in immediate contact with the bronchus open *directly*

into it. Those more remote open only *indirectly*,—that is, *through* those that are nearer. "The multitude of these cells," says Dr. Morton, "and the great space they must afford, by their collective internal surface, may be, in some measure, conceived of from the calculation of Rochoux, that the number of air-cells grouped around each terminal bronchus is little less than 18,000, and that the total number in the lungs amounts to six hundred millions." From this construction of each lobule it is seen, that the passage of air through any terminal bronchus must distend the air-cells connected with that bronchus, not simultaneously, but in quick succession.

The first element of healthy respiration, then, called the *tubal* or *bronchial* sound, is made by the passage of air through the bronchial tubes. It is a clear blowing sound, somewhat resembling what may be made in the mouth and fauces, by quickly inhaling the air, with the mouth a little open. It is most distinctly heard directly over the large bronchi, at the root of the lungs; but is appreciable, also, to a considerable distance from those parts. Indeed, passing from the root of the lungs, there is a diminution of the bronchial sound, until it is fully masked by the vesicular. This diminution is measurably uniform, but not entirely. At the summit of the lungs, or in the subclavicular regions, the bronchial character of the sound is quite as evident, as it is a little lower, and nearer the pulmonary roots;—owing, probably, to the comparative thinness of the muscular tissue, upon the superior portions of the thorax.

It should, also, be here remarked, that, owing to an anatomical fact already alluded to, the bronchial sound, both anteriorly and posteriorly, is sometimes appreciably louder, on the right, than on the left side.

This sound, though purer, or less modified by the second, in expiration than in inspiration, is yet feebler in the former case than in the latter. Indeed, the act of expiration is usually, in health, considerably shorter than that of inspiration; the former being variously estimated as one fifth, one third, and one half of the latter,—the last estimate, however, being evidently the nearest to the truth. And, while the act itself is shorter, the sound generally ceases to be audible before the expiration is closed.

Some have considered, that the original seat of the bronchial sound is in the fauces and nasal cavities, and that it is little more than conveyed by the bronchial tubes to the part over which it is heard. This, however, is clearly an error. We know, from the nature of wind instruments, and from the effect of blowing strongly into any tube, that sound is produced in every part of the calibre; and so it must be with the air passages. The quality of the sound, however, is given by the size of the calibre and other conditions. Hence, the same current of air which, at length, enters the bronchial tubes, to produce a sound there, produces, while passing through the trachea, a fuller and coarser sound, to which we give the name tracheal respiration; but tracheal respiration is not bronchial, nor bronchial tracheal.

The second element of healthy respiration, called the *vesicular* sound, is made in the air-cells or vesicles, partly, perhaps, by the vibration of the air in those cells, but, more especially, by their simultaneous and successive expansion. It is a gentle breezy sound, very much resembling the strong whisper or breathing out of the word *awe;* and, on account of its character, is often described as a murmur, or called the vesicular murmur. It is best heard, or is least masked by the bronchial sound, over those portions of the lungs containing the greatest number of vesicles and only the smallest bronchial tubes; that is, in general, the portions most remote from the root of the lungs, particularly the base anteriorly, and the axillary and sub-axillary portions laterally.

This sound, from the manner in which it is made, is confined chiefly to acts of inspiration. In expiration, the vesicles empty themselves gradually; and, hence, scarcely give rise to the vesicular murmur. There is very little opportunity for a rustling of the air against the sides of the cells, and almost none for a crackling to be produced by the movement of the walls.

In the dilatation of the vesicles, they are forced open by the entering current of air, and somehow the vesicular murmur is produced. This is proved by creating an artificial respiration with an animal suddenly killed. As the air enters the vesicles, the murmur may be distinctly heard; but expel the air from the vesicles, and they empty themselves almost noiselessly. In inspiration, the vesicles become the terminating and impinging

points of the air. In expiration, there is no terminus, but the current passes freely to the external world. In the dilatation of the vesicles, in inspiration, the pulmonary tissues are moved by the mechanical pressure of the air within,—the parts being displaced, not simultaneously, but as one tissue crowds upon another. In the contraction of the vesicles, in expiration, probably their walls collapse first, and the outer tissues follow, without pressure one upon another.

The vesicular sound differs in intensity in different individuals in health. As heard with some, it is always feeble; with others, it is comparatively loud. With persons of a nervous temperament and consequent rapid respiration, it is louder than with those of a different temperament, though more robust and athletic. In general, it is louder in women than in men, and in children than in adults. It is mainly, indeed, the increased strength of the vesicular sound, which makes a peculiarity of respiration in children, and has given rise to the phrase *puerile respiration*, and, in disease, to signify supplementary or increased healthy respiration in one lung, in consequence of impaired action on the part of the other. Puerile respiration, however, supposes, to an extent, an increase of the bronchial, as well as of the vesicular sound.

In ordinary respiration, the vesicular sound is never complete, though in some persons it is nearer so than in others. Fully to dilate the vesicles always requires a forced respiration; but the inferior portions of the lungs call for a greater respiratory effort, than do the superior; inasmuch as the bronchial tubes, in the former case, have to pursue a longer course, and become more reduced in size.

The two sounds now described, the tubal or bronchial and the vesicular, enter in a degree, into every healthy respiration; but the vesicular is scarcely observable in the expiratory act. In inspiration, the bronchial sound is least modified by the vesicular directly anterior or posterior to the large bronchi. The vesicular, on the contrary, is least modified by the bronchial, as heard from those parts of the thorax most remote from the large bronchi, particularly at the base of the lungs, anteriorly and posteriorly, and at the lateral portions of the thorax. Over the medium-siz-

ed bronchial tubes, equally removed from the largest and from the vesicles at the extremities of the smallest, the two sounds are mingled the most equally; but, in health, perhaps neither of the two, in inspiration, is heard from any part of the lungs, without being mingled, more or less, with the other. In expiration, however, the bronchial sound is but slightly modified by the vesicular. It is true, that it differs, very appreciably, from the most marked form of bronchial respiration in disease; but this, probably, is to be mainly ascribed to the elasticity of the tubes and the softness of the surrounding pulmonary tissue,—circumstances very different from those which give the morbid character to the sound.

The bronchial sound of health, as least mingled with the vesicular, is very commonly called the blowing sound. I usually describe it, as the blowing or healthy bronchial sound. The respiration, as heard over the greater portion of the lungs and having the vesicular element very distinct, is often called the respiratory murmur; but, as this sound is limited to inspiration, it is, with equal propriety, called the inspiratory murmur.

There are some *varieties* of healthy respiration, which require to be carefully noticed. I have already spoken of the respiration of children, as being characterized by an increase of both the healthy sounds, but, especially, the vesicular. This peculiarity seems to be owing essentially to the facts, that the parietes of the thorax with children, are comparatively thin, and, especially, that there is, in early life, a greater activity of the respiratory organs, by which the air is driven into the lungs more forcibly. I now remark, that, in advanced life, the respiration becomes more feeble than it is in middle age, from the diminished activity of the vital functions. The muscles of respiration have less energy, and, probably, the pulmonary tissues themselves are less susceptible of vigorous action. This diminution of force characterizes both sounds; but is quite as perceptible in the bronchial as in the vesicular.

There are other varieties dependent on the peculiarities of physical developement. In corpulent persons, the temperament and other conditions being equal, the respiration, as heard, is more feeble, the adipose matter of the chest being a bad conductor of sound. The serous infiltration of the areolar tissue,

produced by disease, may have the same effect. The lungs may act normally; but the sound is obstructed in passing to the ear. In females, the mammary glands repress the sounds in portions of the chest.

There are, also, varieties dependent on accidental causes, as the influence of digestion, muscular exercise, nervous excitement, and the like; but these do not require a delineation. The discriminating judgment and practical tact of the experienced auscultator will be his best guide.

The elements of healthy respiration, as now described, should be thoroughly studied by every one who desires a correct knowledge of auscultation, or who designs ever to practice it. I would recommend, to every learner, to take frequent opportunities to listen to the bronchial sound at the root of the lungs, and to the vesicular, at the inferior and lateral portion particularly. I would also advise him to make his examinations, with individuals of different ages, temperament, and conformations, and of both sexes. In this way, he will, by habit, the better discriminate the radical features of the two sounds, and will learn to trace these, amidst numerous shades of difference arising from incidental causes. Having formed, for himself, an idea of each sound as distinct as possible, he will be able to detect each element of respiration, even where the sounds are most equally mingled and thoroughly blended.

It is well, too, to be familiar with the differences resulting from voluntarily modifying the act of breathing. A protracted and forced inspiration, by more thoroughly dilating the air-passages, particularly the vesicles, will considerably vary the character of the sound. A strong but short and hurried breathing will also give a peculiarity.

And, finally, one must accustom himself to the influence produced, upon portions of the lungs, by the solid viscera in immediate proximity. The heart affects the sound of a certain portion of the left lung, and the liver that of a different portion of the right.

Having formed a distinct conception of the sounds which characterize healthy respiration, one is prepared to understand the various departures from that respiration; in other words, the abnormal or morbid respiratory sounds.

Section III.

THE DISEASED SOUNDS OF RESPIRATION.

The diseased sounds of respiration are made while the air is passing through portions of the lungs, and their character depends especially on the size and form of the air-passages, the manner in which the air impinges against the sides and angles of those passages, and on the circumstances under which the sounds are conveyed to the ear.

These sounds are variously modified. Those modifications, however, which are the most marked and which first demand our attention, are the three following,—the *shrill bronchial* respiration, the *cavernous*, and the *amphoric*.

In general, the *shrill bronchial* respiration differs from the blowing bronchial, or the bronchial respiration of health, in three particulars,—it is less modified by the vesicular murmur, it is louder, and it is heard at parts of the thorax at which, in health, the respiration is mainly vesicular. It is produced by those diseases which harden the parenchyma of the lungs and block up or compress the vesicles. Of course, it differs much less from the sound heard in healthy expiration, than from that heard in healthy inspiration, as it is in inspiration only that the vesicular murmur is distinctly heard. When shrill bronchial respiration is perfect, it is entirely devoid of the vesicular sound; that is, it is perfectly tubal. When the vesicles are in a condition partially to receive the air, the shrill or diseased bronchial respiration is imperfect, and is sometimes called rude respiration.

The increased loudness of the shrill bronchial sound is merely the result of a more perfect conveyance to the ear, by means of hardened tissue. If the induration immediately around the larger bronchi be considerable, the shrill tubal sound will be louder, than when those portions of the lungs in which exist only the vesicles and smaller tubes, are the seat of the disease. The reason is obvious. The larger bronchi are mainly concerned in giving origin to the bronchial sound. Of course, the conducting medium being the same, a greater sound will reach the ear, immediately over those tubes, than at a distance.

But the shrill bronchial sound is very commonly heard, in certain diseases where in health the vesicular murmur is most marked. This is because the induration, obliterating the vesicles, prevents the vesicular murmur, while it, at the same time, conducts the tubal sound more perfectly than does the spongy tissue of health. Perhaps one other circumstance contributes to this result. The smaller tubes, as well as the vesicles, may become obliterated by the hardening of the pulmonary tissue. In that case, the air is suddenly arrested in its passage, and impinges against the walls of the tubes more forcibly, so as to create a greater tubal sound. In a case like this, bronchial respiration may be even louder in remote parts of the lungs, than is the healthy bronchial sound immediately over the largest bronchi.

The disease most fully developing the shrill bronchial respiration is pneumonatis in the stage of hepatization. Tubercles, however, in the second stage, often produce, under a limited surface, a marked instance of this form of respiration. Pleuritis, in the stage of effusion, may so compress the lung as to render the bronchial sound considerably shrill. Scirrhus, too, or other abnormal deposits, may have to some extent, the same effect.

The *cavernous* respiration, as the term implies, is the sound produced by the passage of air into a cavity. This sound, in quality, very much resembles trachea respiration. Until it has been heard, the best idea of it can be gained, by listening, though the medium of the stethoscope, to the sound in the trachea. The principal difference, between tracheal and cavernous respiration, consists in the different lengths of the sounds. In a cavity, the current of air, admitted in inspiration, is suddenly arrested, whirled around for a moment, and then forcibly expelled. This gives a degree of abruptness to the sound. In the trachea, the inhaling effort forces the air along, in one direction and in a steady current, till the close of the act. This renders the sound rather more prolonged than that which is heard in a cavity. Should an unpracticed ear, however, be unable to discriminate, with sufficient accuracy, between the character of the cavernous and that of the shrill bronchial sound, he will be aided in arriving at a correct conclusion, by considering that cavernous respiration is limited to a very circumscribed portion of the lung, while the shrill bron-

chial, if marked, is always more extensive, being limited only by the extent of the indurated portion of the pulmonary tissue. The line of demarcation, too, between the hardened and the healthy portions is not so distinctly drawn as are the walls of a cavity. Hence, in an examination of different points, with a stethoscope especially, we find the shrill bronchial sound losing its distinctive character less abruptly, than the cavernous.

Not all cavities produce a distinct cavernous respiration. One about the size of a walnut, communicating freely with some of the larger bronchial tubes, and having firmer walls of indurated parenchyma, gives the sound in its most perfect character. If the cavity is larger, the air reverberates less fully; and, if the surrounding tissue is measurably permeable to the air, it conducts the sound less perfectly. When a tuberculous cavity has been of long standing and is much enlarged, it will often render but a very indistinct cavernous sound. In such a case, the most hardened portion of the walls is doubtless ulcerated away; and it may sometimes happen, that the tubes opening into the cavity become contracted or otherwise obstructed.

By far the most frequent cause of the existence of pulmonary cavities is tuberculous disease. They sometimes, however, result from the ulceration of pneumonitis in its last stage, and from the sloughing of mortification. There may, also, be a dilatation of the bronchial tubes of such extent as to give, to the respiration, a cavernous character; but, in this case, the sound is more exactly like that of tracheal respiration, as the air pursues its onward course and is not reflected as in other cavities.

Amphoric respiration is really but a modification of cavernous. The sound, however, is peculiar, and, therefore, demands consideration under a distinct name. It is derived from a word in the Latin language, or a similar one in the Greek, signifying a firkin or large measure. Hence the phrase, amphoric respiration, indicates a sound made in a cavity occupying considerable space; but the conditions necessary to its full development are, not only largeness of extent in the cavity, but the existence of firm, tense, and elastic walls. The proper amphoric respiration is a clear and ringing sound, and may be imitated by blowing into an empty flask, a large glass vial, or even a metallic vessel. The best imi-

tation, however, is obtained, by pressing one extremity of a common lamp chimney upon the palm of one hand, and then resting the back of that hand on the ear, while another person breathes forcibly into the other extremity of the chimney. If the cavity giving rise to the amphoric sound has a free communication with the bronchial tubes, the peculiar ring will be heard in both inspiration and expiration ; but, if this communication is so interrupted that the air is discharged but slowly, the expiration will be attended with but little sound and that not distinctive.

Amphoric respiration is most commonly produced in a tuberculous cavity, under the conditions already named. A gangrenous cavity, however, may produce it, in a degree ; but the surrounding tissue, in this case, is generally too soft to render the peculiarity very marked. The amphoric sound is said to have been heard in cavities created by pneumonitis ; but the cases in which its character is very appreciable, must, I am sure, be exceedingly rare. The most marked degree of the peculiarity is in pneumothorax. In this case the pleural sac becomes the cavity, and there is a perforation or fistulous opening into it from the air-passages. The cavity is, of course, large, and its walls are sufficiently firm, tense, and elastic.

There are some other varieties of respiration which deserve a passing notice. Among these, the most important is the rude bronchial respiration. I use this term, not to denote merely an imperfect form of the shrill bronchial sound, or to imply, simply that the vesicular murmur is *somewhat*, though *feebly*, heard, modifying the bronchial sound. I use it rather to denote a rough or husky sound. It is not distinctly tubal, like the shrill bronchial, nor having the breezy smoothness of the vesicular. It is probably made by the action of small fibrilla in the air-tubes, while, it may be, that the calibre of the tubes themselves is somewhat reduced, either by the existence of incipient tubercles pressing on the tubes, or by the thickness of their coats in inflammation.

I am not, however, indeed, fully satisfied as to the pathological condition which gives rise to this sound. I have heard it in the most marked form, in connexion with a degree of chronic hoarseness, and a chronic cough, which by some would be termed ner-

vous. In this case, there was, at the same time, considerable evidence, that incipient tubercles pervaded the lungs. On the whole, my impression is, that the condition of the tubes approximates that which produces the sonorous rale, yet to be considered and heard particularly in acute bronchitis. The peculiarity of the patient's constitution, in connexion with the diseased condition of the pulmonary parenchyma and of the membranes of the tubes, may cause a viscid and delicate secretion, which, by its dryness, takes on a fibrillous or ciliated form. If so, the peculiarity of the sound would, in strictness, rank it with the rales; but it is so slight a modification of the respiration as scarcely to merit a consideration with that important class of sounds. At any rate, the sound is worthy of the further consideration of pathologists.

Another variety of respiration is the interrupted or jerking. In this, the air seems to be measurably arrested in the tubes, for an instant, before it passes on to the vesicles. The quantity of the sound is essentially normal; and the respiration takes its name solely from the broken manner in which the air passes.

It arises from different causes. In a nervous sensitive patient, it is often produced by spasm, under the influence of excitement. In bronchitis, a thickening of the walls of the smaller tubes, by inflammation, may produce it. So, too, may simple congestion. But the most serious condition which ever gives rise to it, is a deposit of incipient tubercles. This, of course, limits the sound to that small portion of the lung in which the tuberculous disease is commencing. It is a symptom of but little importance, except as, in this last instance, it becomes a sign of phthisis.

Dr. Bowditch speaks of what he call mucous respiration, and says that, in it, "the respiratory murmur seems more moist than natural, almost enough so to produce a crackling rale." He says, "it may be heard, throughout both lungs, but is most distinct at the lower and posterior portions." According to him, the sound is indicative of chronic bronchitis; and a fit of coughing will sometimes so augment the secretion as to produce the mucous rale. Though he speaks of the existence of this sound as a discovery of his own, and says he is not aware, that "others have noticed it," yet, to my mind, it is perfectly clear, that he attempts

to describe what Dr. C. J. B. Williams calls the *sub-mucous rhonchus*. Dr. W., having spoken of the mucous and gurgling rhonchi, says, "when there is a little liquid in the smaller bronchi, the bubbling or crackling is more regular, although the sound is weaker, and is sometimes only a roughness added to the ordinary respiratory murmur. This is the *sub-mucous rhonchus*. It may result from slight degrees of bronchitis, and owes its importance only to its being permanently present, when such slight inflammation is constantly kept up by the irritation of adjacent tubercles in an incipient state." I am not aware of having myself noticed a peculiarity of this kind worthy of any separate description. It is perfectly conceivable, however, that the bronchial tubes may be a little moistened with a thin or mucous secretion, and yet the quantity of this secretion may not be sufficient fully to develope either the mucous or the subcrepitant rale. That the sound, when in exists, should in strictness, be classed with the rales, rather than as a simple sound of respiration, is, to my mind, clear. The peculiarity is evidently produced by a slight liquid obstruction, and not by the mere force of the air striking against the walls of the air-passages. Still, such nicities of classification are practically of but little importance; and the sound is so slight a change from the normal respiration, as hardly to entitle it, in description, to the dignity of a rale.

Beside these modifications of the respiration, still others may be named. Both the normal sounds may be increased, or they may be diminished, without any other change of character. A portion of the lungs may become so compressed or so diseased, as to be impervious to air, and incapable of performing the proper office. In that case, another portion will act with increased energy, and give a louder sound of respiration. Instances of this are observed in pleuritic effusions, and in pneumonitis. Even in bronchitis, there may be so much lesion of the bronchial tubes as to obstruct the passage of air into one part, and thereby give an increase of sound in another part.

Again, the sound of respiration as it reaches the ear, may be less than is normal, in consequence of disease in the structure of the lungs or in parts adjacent. In emphysema, for instance, both the bronchial and the vesicular sounds are enfeebled. In bronchi-

tis, too, this sometimes occurs. In phthisis, it is frequently observed in a portion of one lung; but, in this disease, there are usually, perhaps uniformly, other alterations of the respiratory sounds. In the second stage of pleuritis, in hydro-thorax, in empyema, or whenever the pleura contains a liquid of any kind, the respiration, as heard, is more or less feeble, partly by reason of the compression of the bronchi and vesicles, and partly because the interposed liquid interrupts the conduction of the sound to the ear.

Section IV.

RALES.

Rales are an important class of sounds, made, indeed, by the passing of air through air-passages, but yet in a manner somewhat different from that in which the simple diseased sounds of respiration are produced. The rales always suppose impediments or partial obstructions to the passage of the air; and it is the resistence met with which mainly gives the modification of sound.

The term *rale* has been transferred from the French to express an idea for which we have had no authorized English word. Even this, in the original, is far from giving the exact meaning. It merely signifies a *wheezing*, or a *rattling* in the throat. Some pathologists prefer the Latin term *rhonchus*, which signifies a *snoring* or *snorting*. The idea being a new one, of course, to express it, a new term must be adopted, or there must be an accommodation of an old one. Either expedient is well enough; and the term *rale*, or *rhonchus*, or even the simple English word *rattle*, will convey the idea, when once its application is defined and understood. I prefer the term which I have adopted, simply because it is a monosyllable and easily pronounced, while, orthographically, it forms its plural after the usual English manner.

The rales are properly divided into the *dry*, and the *moist* or *humid*. This distinction is founded on the nature of the impediments which produce the sounds. These impediments are either solid or liquid. The dry rales are three,—the *sibilant* the *sonorous*, and the *crackling*.

The *sibilant* rale is a musical or gently whistling sound. It may be sufficiently well imitated by whistling between the teeth, with the lips partly closed or slightly apart. It is produced by the passage of air through a small and rather circular aperture. This aperture is generally formed by a slight obstruction in one of the smaller tubes, though it may be made by a greater obstruction in a tube of larger size. The sound is extremely moveable, and equally irregular in the time of its reappearance. Heard, at one point, in one respiration, in the next, or not until some subsequent one, it may be heard at some point remote from the first. It exists, both in respiration and expiration; and from the situation of the smaller tubes from which it mostly arises, it is mostly heard over those portions of the thorax, especially the anterior, which are a little remote from the pulmonary roots. Under different circumstances, however, it is heard over almost every portion of the chest, anterior, posterior and lateral.

It is produced in asthma, in which the tubes are congested, and are constricted by the spasmodic contraction of their circular fibres. In this disease, particularly if severe, it is a protracted sound, heard in both inspiration and expiration. In bronchitis, the tubes may be so narrowed, by the swelling of their mucous and submucous coats, as to produce it. In the third stage of phthisis, it is quite frequently heard, in connexion with other diseased sounds,—the tubes being constricted by the muco-purulent matter which passes into them. In the latter case, the sound is short, and is generally heard from different tubes during the same or successive respirations. It may be caused, in different diseases, by such an adherence of viscid mucous to the walls of the tubes as diminishes their calibre.

The *sonorous* rale might, with more special propriety, be called a rhonchus. It is more of a snoring sound, or like deep guttural breathing, than any of the other rales. Various similitudes have been adopted to describe it. It has been compared to the sound of a bassoon, and to that of a bass-viol;—to the cooing of a pigeon, to the hum of insects, to the sounds produced by a piece of paper fluttering in the wind, and to the grating of a cart-wheel upon snow in weather severely cold. But, whatever idea may

be formed of it, from these and like comparisons, it is sufficient to say, that it is a deep cavernous sound, so unlike any other produced in the thorax, that when once distinctly heard, in its marked form, it may ever afterwards be recognized. It, however, varies considerably in tone, according to the circumstances under which it is created. It is produced by such an obstruction as leaves a flattened aperture. It is a *vibrating* sound; and either the walls of the tubes generally, or the lips of the aperture, where the obstruction exists, must be the seat of the vibration. The latter is probably the true explanation. A partial "swelling of the sides of a tube, particularly at its bifurcation, a pellet of tough mucous in it, or external pressure on it," may give the proper aperture to produce the sound; but then there must be, in addition to the form, a vibrating surface. I am of the opinion, that a viscid secretion assuming a fibrillate or stringy character, is really the vibrating substance, though it may be that the substance of the tubes, when hardened by inflammation, is capable of vibrating. It is mainly produced in the larger bronchial tubes, though sometimes in those of medium size. In the latter case, the sound usually has a higher note than in the former; though it would seem that the size of the aperture, at the point of partial obstruction, is principally concerned in giving key to the sound. It is most heard both anteriorly and posteriorly, when the ear is placed in most immediate proximity to the larger bronchi. It is well spoken of as a fugitive sound, since it will frequently cease and return, so far as one tube or point is concerned, with almost every act of respiration. It is not, however, always so moveble; and when it is, it still may often be heard with every respiration, though, successively, from different points. It exists with both inspiration and expiration; but is quite as marked with the latter as with the former.

The sound is pathognomanic of bronchitis. In the acute form of the primary disease, it almost uniformly attends the progressive stage. In the chronic form it is not heard. In many cases of secondary bronchitis which attends other diseases, it is heard. If not connected, however, with any of the humid rales, it is indicative of but a mild affection.

I have only to add, that the sibilant and sonorous rales now

described are sometimes commingled; or there is a condition of the tubes which creates a sound partaking partly of each character. A sufficient explanation of this will readily be suggested, on recalling to mind the description of the physical cause of each sound.

One other dry rale remains to be considered. It is the *crackling*. So far as I know, this has never, by pathologists, been particularly described; and yet it seems to me to be a peculiarity worthy of a definite description. The sound has generally been classed as a *subcrepitant* rale; though by Dr. Gerhard, in the third edition of his work on Diseases of the Chest, it is clearly referred to, under the designation of a variety of the *mucous*. The French, indeed, in their hospitals, speak of it as *un crâquement*, the crackling, but do not assign it a separate rank among the rales. In its marked character, it is pathognomanic of phthisis; and Dr. G. says of it, "It is produced by the softening of the thick pasty matter of tubercle, which gives a peculiarly dry and sharp sound."

Though it merits a distinctive name as one of the rales, yet I have with some hesitation, decided to rank it with the *dry*, rather than with the *humid*. The *sibilant* and the *sonorous* are caused by a thickening, or a spasmodic contraction of the walls of the bronchial tubes, or by something internal, partially blocking up the air-passages. Of course, the parts are, essentially, in a dry condition. The *crackling* rale of phthisis, however, indicates the third stage of the disease, when purulent matter is being discharged from softened tubercles. Still my impression is, that the sound is not produced exactly as Dr. Gerhard supposes, for I cannot understand the *rationale* of such a process. I think, that as the matter of tubercles is softening, some pasty portions block up the entrances just firmly enough to be removed with the full ingress of the air, and that the movement of the partially dry and flaky deposits causes the *crackling* sound. Or it may be, that the change which inspiration effects in the relation of parts of indurated pulmonary substance, is concerned in the matter. As the air passes into the opening tubercles and disturbs their walls, the rubbing of one part upon another may produce a portion of the effect. Of course, so far as this is the case, the sound should

not be regarded as a crackling rale, but should be classed with the adventitious sounds yet to be considered.

When pus, in sufficient quantity, is poured into the larger bronchial tubes, it gives the *mucous* rale, which is very commonly heard, in connexion with the *crackling*, though the latter may precede it, by a period of several days, and afterwards cease, leaving the *mucous* increasingly developed.

Besides the sound now described, there is a comparatively unimportant one, which I know not how better to class than as a *crackling* rale. Dr. Gerhard, if I understand him, speaks of this as the *dry* or *rustling crepitant.* He, however, scarcely describes it, and says that it "is of very little value, and hardly differs from the rustling sound of respiration." By this last phrase, he means what I have yet to describe as the *emphysematous crackling.* Dr. C. J. B. Williams, calls the sound the *dry mucous rhonchus.* He says, "It is produced by a pellet of tough mucous, obstructing a tube and yielding to the air only in successive jerks, which cause a *ticking* sound, like that of a click-wheel. When the air is driven very fast, these, as is the case of other click sounds, pass into a continuous note, and constitute the sonorous rhonchus. Sometimes, again, particularly in inspiration, the click sound suddenly stops,—the tough mucous being forced into a smaller tube, which it completely closes." The sound, which, however, but seldom occurs, supposes a condition of things somewhat similar to that which produces the sonorous rale. It is the result of chronic bronchitis, or a morbid power of mucous secretion; and can hardly be confounded with the tuberculous crackling.

The humid rales are produced by the passage of air through a liquid of some kind, "forming bubbles of different sizes." These bubbles "vary according to the tenacity of the fluid, the size of the air passages, and the greater or less rapidity with which the air is forced through those passages." There are four of these rales,—the crepitant, the subcrepitant, the mucous, and the gurgling. There is, however, no marked line of distinction between the crepitant and the subcrepitant, nor hardly between the subcrepitant and the mucous.

The *crepitant rale*, in its most perfect form, is believed to be made in the vesicles—the very extremities of the air-passages in

the lungs; or, in these, together with the very small terminating "tubes which ramify through the lobules." When the crepitus is not quite so delicate, the sound is probably produced in the small tubes, just before they enter the lobules. To describe this rale, various illustrations have been adopted. It has been compared to the sound produced by rubbing slowly and firmly, between the thumb and finger, a lock of hair near the ear; also, to the effervescing of bottled cider or champagne, to the crackling of salt, and to the successive explosions of a small train of wet powder. It seems to be formed by the rapid and equable succession of extremely fine bubbles arising from the liquid which traverses the smallest bronchi. This liquid is necessarily thin; as what is thick and viscid could hardly pass through the extremities of the tubes, and, especially, would not readily allow the passage of air in so delicate a series of bubbles. Some, however, have supposed, that the dilatation of the vesicles, thickened and stiffened by inflammation, assists in creating the sound. So far as that may be true, it would not come within the definition of a rale. It would be an adventitious sound. I regard the former, however, as the true explanation. The sound is almost pathognomonic of pneumonitis in its first stage; and, in that stage, the secretion into the air-passages is serous in character and thin in consistency. The other conditions which give rise to it are conditions of a thin liquid in the extremities of the tubes. It is confined to the inspiration, as, from the extremities of the tubes, the air is not pressed outward with a force sufficient to create the bubbles. From the nature of the morbid conditions which give rise to it, it must necessarily exist, mainly at the inferior and posterior portion of the lungs, though it may occur elsewhere.

The sub-crepitant rale is a coarser and less regular crepitation than the crepitant. The term is an awkward one to express the idea. It implies something less than the crepitant. It seems, however, to have been originally chosen, not to express that the former sound is less than the latter, but that the delicacy of crepitation is less with the former than with the latter. I use the term, because it is established and for the want of a better. The second is intermediate between the crepitant and the mucous rales, and, by an insensible gradation, runs into the one or the

other, according to circumstances. It is made, in the medium-sized tubes, by the bursting of bubbles through the contained liquid. The size of the tubes renders the sound coarser than is made in the extremities and the vesicles; while the traversing liquid being commonly thicker and more viscid than is found in the smaller passages, causes the existence of less regularity in the succession of the bursting bubbles. This rale is heard chiefly in the inspiration, but very faintly in the expiration. Like the crepitant rale, it exists, principally but not exclusively, at the inferior and posterior portions of the lungs. This results mainly from the nature of the diseases which produce it; though the recumbent, and the upright or partially upright position which the patient generally preserves, favors the passage of the liquid contents of the tubes towards those portions. By far the most frequent causes of this rale are pneumonitis and bronchitis. It is heard in pulmonary œdema, and in hæmoptysis; but serum and blood, being thin liquids, give a peculiar sharpness to the sounds produced with them. The crackling rale of the third stage of phthisis, which is heard mainly at the superior portion of the lungs, has generally been ranked as a form of the sub-crepitant. It is, however, a *dry* sound, and is, withal, coarser than what ordinarily takes this name. For these reasons, I have given it a separate designation.

The mucous rale is a louder and more irregular sound than the sub-crepitant. Indeed, the former is so fugitive, that it may pass away for the time, and not be restored, until a cough has transpired. The bubbling, also, of the former is more distinctly hurried than that of the latter. It is made only in some of the longer bronchi, where they are pretty well filled with a liquid. This liquid is generally pus, or mucus, or a mixture of both. Of course, it is generally thick, but not very tenacious. Serum and blood, however, will give rise to the sound; but, when made by means of them, it will not have its usual softness of tone. When once heard in its marked form, it will ever afterwards be recognised. It very generally exists both in inspiration and in expiration. It is, however, comparatively a faint sound in the latter; and, when the air returns from the lungs with but a feeble force, the liquid is not sufficiently agitated to excite it. The sound

may be looked for, whenever the expectoration indicates that the larger bronchi are incumbered with a liquid which is not very tenacious. It is produced in the developed stage of acute bronchitis, and in the third stage of both pneumonitis and phthisis. Like the sub-crepitant rale, it may, also, be created by pulmonary œdema and hæmoptysis. In some of these diseases,—in phthisis especially,—the rale is, in many instances, frequent and so loud as even to be audible, at a short distance from the thorax of the patient.

One other rale remains to be considered. It is the gurgling. The sound of this does not differ very essentially from that of the mucous. It is, however, even louder, and is more hollow; but it is, at the same time, more concentrated. It is produced in a cavity partially filled with a liquid of moderate tenacity, though of a size varying from that of a large pea to that of an orange, or even to the dimensions of the pleural cavity, in which this contained liquid is generally pus, or muco-purulent matter. The sound occurs in expiration, as well as in inspiration. The reason of this is, the returning current of air, as well as the entering, passes through the cavity and is reflected from its walls in such a manner as to disturb the liquid. Of course, the gurgling rale is almost continuous in its existence. It may cease, however, for a time, in consequence of the cavity's being emptied of its contents. In that case, the sound will be replaced by the cavernous or the amphoric respiration. This rale is, by no means, proportioned, in loudness, to the extent of the cavity. The quantity of liquid, the consistency of the surrounding pulmonary tissue, the amount of air admitted to pervade the cavity, and the position of its point of ingress in relation to the surface of the liquid, are all circumstances modifying the degree of sound. The diseases which give rise to this rale, are those in which pulmonary cavities are formed and partially filled with liquid; and, probably, forty-nine out of fifty of these will be found, on examination, to be tuberculous. Pneumonic and gangrenous cavities, however, occasionally yield the sound; and so does the dilatation of one of the large bronchi. In this last case, a sort of cavity is formed, through which the air freely passes, both in inspiration and in expiration. This cavity, if pus is not present, may yet contain

mucus of such consistency as to give substantially the ordinary gurgling sound.

Section V.

ADVENTITIOUS SOUNDS.

There are certain sounds, which have sometimes been classed with the rales or rhonchi, but which, from the circumstances of their formation, do not fall within the range of the definition usually given to that important class of sounds. I prefer, therefore, to group them together, as a heterogeneous class, superadded to the rales properly so called. Hence the propriety of the designation, *adventitious sounds.*

The first of these I term the emphysematous crackling. It is pathognomonic of the disease emphysema. In this disease, the dilated and stiffened parietes of the vesicles, rubbing against themselves and perhaps against the pleura, in the motion produced by inspiration, cause a rubbing or crackling sound. Dr. Gerhard calls this, in one place, the rustling sound of inspiration, and in another, the dry, sub-crepitant rhonchus. In strictness of definition, however, it seems to me to belong to the adventitious sounds; for, though it results from the respiration, it is made mediately, and not *immediately*, by the action of the air. The air distends the lungs, and the sound is the consequent rustling of the hardened and not very pliant membranes.

Another of the adventitious sounds is the grating sound,—sometimes called the creaking, the friction, the rubbing, and the new-leather sound. It is produced by the friction of the two surfaces of the pleura, when these surfaces are rough with the deposit of fibrin, constituting the condition which has, heretofore, been called that of false membrane. The real pathology of this condition will be elsewhere explained. Suffice it here to say, that, under the laws which govern the reparative process, the hyaline fluid or blastema deposited after the existence of inflammation of the pleura, renders that membrane uneven. When, therefore, an effusion of serous fluid does not keep the pulmonary and the costal portions of the pleura separate from each other, they rub together, in every act of respiration, and produce a sound

very much like the crackling of pieces of parchment or new leather. This sound exists in both inspiration and expiration. When well developed, it is accompanied with a thrilling motion or quivering of the chest, which is very appreciable by the touch. When the deposit of fibrin is small, or when effused serum prevents the full contact of the roughened surfaces, the sound is imperfect, and may very much resemble the crackling rale, or the sub-crepitant. They may generally, however, be distinguished without difficulty. The latter rales follow, more immediately and regularly, the act of inspiration, and they are less fugitive. The sub-crepitant, especially, is, likewise, more equal in its crepitation. Besides, the grating sound is mostly heard towards the lower part of the thorax, where the movement of the ribs is the greatest, and where the hyaline deposit is generally the most considerable. Other circumstances, too, will ordinarily assist in discriminating between the grating, and the resembling sounds. One of the latter may be simultaneously heard, in another part of the lung, and the history of the case may remove all doubts.

The only other adventitious sound to be considered is the metallic tinkling. The name has its origin from the resemblance of the sound to the tinkle of a metallic vessel, when gently struck with some small but solid substance. A few years since, this sound was believed to arise from a drop of liquid falling from the top of a cavity upon the surface of the fluid occupying the lower portion of the cavity. More recently it has been suggested, that the tinkling is made by the bursting of a bubble of air, rising from beneath, upon the surface of the fluid. Possibly, each of these causes may, at different times, create the sound, though I believe the latter to be altogether the more common cause. Possibly, too, the bursting of bubbles in the air tubes, constituting the mucous or the sub-crepitant rale, may sometimes be heard through a cavity, which is filled with air and the walls of which are elastic, giving to the sound, as it reaches the ear, the character of the metallic tinkling. To produce this sound, the cavity must be large. Generally, it is the pleural cavity, but sometimes a large tuberculous one. In the latter case, amphoric respiration is present, and determines the patient's pathological condition. Of course, the tinkling sound is not of much practical value.

Section VI.

THE SOUNDS OF THE VOICE.

In discriminating, between a healthy and a diseased condition of the lungs, and between different forms of disease, we are sometimes considerably aided by the peculiar sound of the voice, as heard from the thorax. Several circumstances, however, so modify the vocal vibrations, that we cannot rely on this means of diagnosis alone. The comparative thickness of the intercostal muscles and the amount of adipose tissue upon them, have an effect on the sound,—a patient the walls of whose chest are emaciated yielding a fuller resonance in consequence; while a large deposit of fat renders the sound feeble. The natural tone of voice, too, is concerned with its power of vibration. A bass voice is more resonant than a higher-toned one, and a naturally strong voice than a feeble one. Still, to some extent, the peculiarities of the voice correspond with the varieties of respiration. "In the ordinary act of speaking, the voice vibrates throughout the chest; and, if the hand be placed upon its parietes, a slight tremor is very perceptible. If we apply one ear to it, the other being closed, we shall hear a distant and confused sound." This sound is comparatively loud, if we listen immediately over the large bronchi; and it becomes less, in proportion to the increase of the distance from those parts. The principal variation from exact proportion, has reference to the summit of the lungs, especially on the right side. The reasons already named, as varying the bronchial sound of respiration, have, also, an equal effect on the voice.

Generally, where the vesicular structure abounds, and the bronchial ramifications are small, we have, in health, but a faint vibration of the voice. This may, therefore, be said to correspond with the vesicular murmur. Directly over the large bronchi, where the blowing bronchial sound of health is most marked, we have a strong vibration of the voice, which is usually called bronchophony, a sound from the bronchi. This may be described as a thrilling sound, in which no articulation is discoverable, and which seems to reach the ear as coming from the vocal

cords or some point at a distance. It corresponds with the blowing bronchial respiration.

Diseases of the chest often modify the vocal resonance. Sometimes it is diminished. In emphysema, for instance, the increased quantity of air in the lung, renders it a bad conductor of sound; and, hence the voice is heard more feebly. Liquid effusions into the pleural cavity, if considerable, compress the spongy texture of the lungs, flatten the bronchi, and partially or wholly destroy the vocal resonance.

Most diseases of the chest, however, cause the voice to resound more strongly than it does in health. Bronchophony, as already defined, is generally produced, where it is not heard in health, by those diseases which cause bronchial respiration; and it is produced in the same portions of the lungs as the bronchial respiration. This sound, too, is usually more or less intense, according as the bronchial respiration is more or less shrill and tubal. The principal variation from the rale is in the case in which accumulated mucus obstructs the bronchi too fully to be removed by the act of speaking, but so that it is removed by a strong respiration. In this case, the vibrations of the voice are prevented, though the respiratory sound is not. In the most marked form of bronchophony, articulation seems almost to be heard, and the sound varies but little from pectoriloquy. The induration of a portion of the lung, in the second stage of phthisis, yields bronchophony; and pneumonitis, in the stage of hepatization, produces it in its most perfect form, Dilatation of the bronchi will increase the vocal resonance; but this is substantially of the nature of pectoriloquy. In all these cases, the principal evidence of the presence of disease, derivable from bronchophony, is its existence at points from which it is not heard in health. It is often, however, decidedly more distinct, than it ever is in health.

Pectoriloquy, a speaking from the chest, is a resonance of the voice yielded by an ordinary cavity in the lung, or such a cavity as produces cavernous respiration. Of course, it corresponds essentially with cavernous respiration. In its most marked form, the vocal sound seems *almost* to be articulate, and to have its origin in the cavity from which it comes to the ear. In these two particulars, the resonance differs from that of bronchophony.

When somewhat imperfect, however, the former can hardly be distinguished from the latter. A large bronchial tube surrounded by hardened pulmonary tissue may yield even a more thrilling sound than a cavity surrounded by spongy pulmonary structure and not so situated as freely to receive the external air. The most perfect pectoriloquy comes from a cavity of moderate size, entirely emptied, and having indurated walls. But pectoriloquy is seldom very perfect. A cavity is liable to be obstructed with muco-purulent matter, even if the other requisites to the creation of the sound are permanently present. Hence the sound is fugitive; and cavernous respiration, together with the gurgling rale, is a more valuable guide in detecting the pathological condition, than pectoriloquy.

Amphoric resonance of voice is a modification of pectoriloquy, heard from such a cavity as gives amphoric respiration. The difference between this sound, when marked, and pectoriloquy is, the former seems somewhat "more hollow, more distant, and more diffused," than the latter. If the cavity is one of considerable size, the resonance is generally a clear ringing or quite metallic sound, somewhat like the noise produced by speaking into a glass tumbler or large open-mouthed vial, without entirely closing the opening. This is especially the case, when the pleural sac becomes the cavity, in consequence of a communication made with the bronchi. In a tuberculous, pneumonic, or gangrenous cavity, the tone is not so short and the resonance is not so clear. It may even happen, that a cavity producing the amphoric respiration, but, not being very large, shall be in such a condition, that the amphoric resonance will scarcely differ from pectoriloquy. If the parenchyma of the lungs around the cavity is soft and permeable, the resonance is generally quite obscure. If the bronchi become obstructed, it will, of course, entirely cease.

Egophony, sometimes written ægophony and hægophony, is a peculiar quivering sound, and takes its name from two Greek words signifying the sound of a goat. It resembles the bleating of a goat or a sheep, and may be tolerably well imitated by speaking through a common speaking trumpet. The sound is really bronchophony, modified by the influence of a pleuritic effusion, or the existence of a thin liquid in the pleural cavity.

In order to its production, however, it is necessary that the quantity of the liquid be limited. Generally, the lung must be moderately compressed, but not much flattened by the pressure. Hence the sound is heard, in the second stage of pleuritis or in hydrothorax, when the water is beginning to collect, and when it is nearly absorbed. Too small a quantity is not sufficient to afford the vibrations. Too much so compresses the lung that the air is prevented from sufficiently filling the bronchial tubes. If, however, the substance of the lung happens to be somewhat rigid and solid, in consequence of previous inflammation, so as to produce strong bronchial respiration, the egophony will continue, as the water increases, much longer than it otherwise would do. It may last even during the whole existence of the disease. Still it is, ordinarily, quite transitory, passing away in a few days. Egophony, when existing, if the patient sustains the upright posture, is most distinctly heard, posteriorly, near the lower margin of the scapulæ; but, with a change of position, there is a change in the audibleness of the sound, — it being best heard about the upper portion of the liquid, except so far as obstacles to the conduction of the sound modify the result.

CHAPTER X.

RATIONAL SYMPTOMS.

Section I.

DYSPNŒA.

As diseases of the thorax, to a greater or less extent, affect the respiration, a few general remarks on the subject of dyspnœa are not inappropriate in this place. There are four circumstances, particularly, the existence of any one of which will disorder the respiration, unless its influence is by some means counterbalanced. These circumstances are certain disordered conditions of the blood, a deficiency in the quality or quantity of inspired air, a defect in the machinery designed to bring the blood and the air into contact, and a diseased state of the nerves, whose office is to invite to action the muscles of respiration. To some

extent there may be a balance of influences. For instance, the distress which would otherwise arise from a deficiency in the quality of air allowed to enter the lungs, may be prevented by such a diminution of nervous sensibility as renders the patient insensible to the want experienced. Dr. C. J. B. Williams has given us the following table, showing what he calls "the proximate causes of dyspnœa."

The table is very accurate and appropriate; though not being founded directly on the circumstances which I have named *as remote causes*, the classification is not what those circumstances would directly suggest. I would here remark that the original import of the term, *dyspnœa*, is *difficult breathing*, and Dr. Williams has here used it in a sense so extensive as to embrace the slow labored respiration of coma, though it is ordinarily limited to what is hurried and distressing, and it is in this sense, mainly, that it is concerned with diseases of the thorax.

1. By impeding the access of pure air to the lungs.
   a. *Mechanical.*
      Rigidity of parts of the respiratory machine:—
         e.g. Ossification of cartilages; induration of the pleura; rickety distortions.
      Pressure on ditto:—
         e.g. Tumors or dropsies of the abdomen.
      Obstructions of the air-tubes:—
         e.g. Effusions in, swellings of, tumors pressing on, the air-tubes;
            Spasm of the glottis; spasm of the bronchi.
      Compression of the lungs:—
         e.g. Effusions or tumors in pleural sac;
                  Pleurisy,
                  Hydrothorax,
                  Pheumothorax,
                  Aneurism, &c.
      Alterations in the tissue of the lungs:—
         e.g. Engorgement,
            Effusions:—
                  Œdema,
                  Hepatization,
                  Tubercle, &c.
            Altered structure:—
                  Emphysema,
                  Dilated bronchi,
                  Vomicæ, &c.
   b. *Chemical.*
      Deficiency of oxygen in the air:—
         e.g. Mephitic gases; rarified air.

c. *Vital.*

Pain of parts moved in respiration :—

e.g. Pleurodynia; pleuritis; peritonitis, &c.

Paralysis of muscles of respiration :—

e.g. Injuries of the spinal marrow on the neck, &c.

Paralysis of the bronchi (?)

Weakness of ditto :—

e.g. Excessive prostration, from ataxic fevers, &c.

Spasm of ditto :—

e.g. Tetanus; spasmodic asthma, &c.

2. By the state of the blood.

a. *Mechanical.*

Obstruction to the passage of the blood :—

e.g. Diseases of the heart and great vessels; tumors pressing on them.

b. *Chemical.*

An excessively venous state :—

e.g. Violent exertion; idiopathic dyspnœa (?)

Deficiency of red particles :—

e.g. Anæmia; cholorosis.

3. By the nervous relations of respiration.

Excessive sensibility of the par vagum :—

e.g. Hysteric dyspnœa; cerebral fevers; neuralgia (?)

Defective ditto :—

e.g. Coma: narcotism, &c. (breathing slow.)

The standard of healthy respiration, in an adult, is not far from *sixteen breaths* in a minute, though it may range from twelve to twenty, consistently with the existence of comfortable health. Disease, especially inflammation of the lungs and the pleura, may increase the respirations to thirty or forty per minute, and violent disease may raise them as high as even sixty or seventy. In children, the respiration, both in health and in disease, is more rapid in the increase ratio of age; and, in general, with females it is rather quicker than with males.

In acute affections, the degrees of dyspnœa is usually not far from proportionate to the extent of the disease. In chronic cases, however, it is quite otherwise. The nervous irritability may gradually be so deadened, and the functions of the system so accommodated to the depressing influence, that there shall be but little variation in the respiration, even though there is a great deal of thoracic disease. On the contrary, the nervous irritability may become so exalted as to quicken the respiration and alarm the patient with a sense of dyspnœa, when the existing organic disease is but trifling. Still farther, there may be a hurried respira-

tion without the patient's being sensible enough to perceive it; or, on the other hand, a respiration scarcely quickened, while he anxiously imagines the existence of serious respiratory disturbance. There are other modifications of the respiration, caused particularly by peculiarities of nervous influence; — such as the suspicious breathing, or the taking now and then of a sigh or deep breath, — and comatose breathing, or a slow and struggling effort of vitality to sustain the respiratory process. The true nature of these conditions I design to illustrate in another volume. The knowledge of their pathology is not necessary to a practical understanding of the subject on which I propose now to treat.

Section II.

COUGH.

A cough is so common an attendant of diseases of the thorax, that a few general remarks on the subject are here not out of place. It may be defined to be an abrupt or convulsive expiration or series of expirations, in which there is a continuation of the glottis, trachea, and larger bronchial tubes. When several expirations constitute the series, this is immediately succeeded by a loud and forcible inspiration, which, in its most marked form, constitutes what is commonly called *a whoop*.

Coughs have many varieties of character, some of which are expressed by the phrases a short, dry or hacking cough, a nervous cough, a sonorous cough, a suppressed cough, a stridulous cough, a loose cough, a hollow cough, a spasmodic cough. These terms, which sufficiently explain themselves, are not separately characteristic of particular diseases; as the same form may arise from different diseases, and different forms from the same disease. Indeed, so indefinite are the shades of character which a cough assumes, that its various *phases* cannot easily be described.

Again, coughs may be classed according to their exciting causes. These are various, but may be divided into two general classes, — the existence of some irritating substance within the air-tubes, — and a morbid irritability of the sentient portions of those tubes, or some portion of the respiratory apparatus. The

cough, in the first instance, may be called *excretory;* and in the second, *irritative.*

The design, or as logicians say, the *final cause* of the excretory cough, is to eject the offending matter or exciting cause. Of course the effect of agents tending to suppress it is injurious; and the object of remedial means should be to assist nature to remove that which creates the irritation, even though, as is sometimes the case, the cough be thereby increased. The irritative cough proceeds from causes which are governed by a general law in the animal economy, and has no immediate *design* or *final cause.* Its tendency is only injurious; and the object of medication should be to suppress it, by subduing the excessive irritability. But these classes of coughs, however, may be, and often are, united; in other words, the cough partakes, in part, of each character. Of course, the treatment should have in view a two-fold object.

The excretory cough may be produced by the existence of a foreign body in a portion of the air-tubes. For example, a person incautiously allows a portion of food or drink to enter the glottis. This suddenly developes a cough, the violence of which will be proportioned in part to the irritating nature of the substance. The effect of any thing highly stimulating, like vinegar or pepper, will be more severe than that of simple water or bland food. The diseases which mostly create this class of coughs are affections of the mucous membrane of the air-tubes and of the parenchyma of the lungs, which is in juxtaposition with this membrane. In these diseases, the cough will be more or less teasing or tickling, according to the character of the excreted matter in the tubes. A strong saline excretion may produce a loud sonorous cough; whereas thick mucous, or pus, or blood, with little chemical power, will only create a mild, though, perhaps, frequent mucous cough. In most cases of bronchitis and pneumonitis, however, the cough is more or less mixed, and not purely of the excretory kind.

In regard to the irritative cough, there may be an increased sensibility of the tubes resulting from local inflammation. In bronchitis, the mucous membrane of the bronchi is inflamed, and the morbid irritation is the result. This, in the first stage of the

disease, gives rise to a cough, though there is little or no secretion. It is a dry and perhaps a hard cough of the irritative kind. In the second and third stages, the cough is of a mixed character. There is a secretion which needs to be expectorated, and, at the same time, the sensibility of the tubes is increased by the inflammation. In pneumonitis, the case is much the same. The cough depends, in part, on the irritation of the mucous membrane of the bronchi. Incipient tubercles, presenting a moderate but irremovable irritation, will keep up a hacking cough, with little or no expectoration. This may be so severe as to be quite troublesome to the patient, or so slight as almost to escape his notice. In severe ulceration of the larynx, we have a stridulous cough, sometimes almost whistling, and sometimes measurably stifled. An elongated uvula will occasionally so irritate the fauces as to produce a tickling cough.

Not unfrequently the morbid irritability of the air-tubes is owing simply to a weak and excited state of the nervous system, — no inflammation whatever being present. In pleuritis, there is inflammation in the thorax, but it does not directly affect the air-tubes. The cough, in this case, therefore, seems to be strictly of the irritative character. In consequence of the pain which the cough, in this disease, is liable to produce, it is generally checked, in a measure, by the volition of the patient. Hence, it is often spoken of as a suppressed cough. Sometimes there is a spasmodic contraction of the air-tubes, and especially of the aperture of the glottis, and the cough is, accordingly, wheezing or convulsive. In asthma, the bronchi are spasmodically contracted, and we have the wheezing cough. In pertussis, there is a spasm of the glottis, and we have a strong convulsive cough, together with the peculiar whoop of that disease, made by a full and forcible inspiration. In this disease, the irritable cough is owing partly to a spasmodic condition of the air passages. There is also a copious secretion, so that the cough is excretory as well as irritative.

In many cases of irritative cough, it would seem that the abdominal and intercostal muscles, or, in general, the muscles of respiration, possess a peculiar mobility or disposition to contraction, and that to this fact we are principally to look for the proxi-

mate cause of the cough. This is particularly true of nervous, and, especially, of hysterical subjects.

Besides the case of spasmodic contraction, we sometimes have a weakened condition of the circular fibres of the bronchi, and a consequent deficient action. This is of the nature of partial paralysis; and the cough, from the unusual openness of the tubes, is hollow and hacking. This cough is sometimes heard in chronic bronchitis, and, occasionally, in connexion with febrile and nervous affections; and if, perchance, there exists also a morbid mobility of the muscles of respiration, the cough will be very convulsive and paroxysmal.

Section III.

THE SPUTA.

Expectoration properly signifies the act of expelling something from the chest, though the term is also used to signify the matter expelled. To express the latter sense, however, sputum, the plural of which is sputa, is the more definite and desirable term.

Expectoration, though often accomplished in part by coughing, is yet, in a good measure, a voluntary exercise, consisting of hawking and spitting. By the former act, the sputa are raised from the trachea or bronchial tubes, into the mouth, and by the latter they are ejected. Children do not voluntarily expectorate till they are about six years of age, and but seldom afterwards till they arrive at or near the age of puberty. In advanced age, persons generally have less power of expectoration than in earlier life; and, *in articulo mortis*, the rattle in the throat, very commonly heard, is the result of inability to free the air-passages from the accumulating matter.

In order to hawk effectually, air must first have been so thoroughly inspired as to pass beyond the matter to be expelled from the tubes. This matter is then dislodged by the forcible expiration which is involved in the act of hawking. The anatomical structure of the air-passages is such as to favor the ejection of the sputa, both in the act of coughing and in that of hawking. The aggregate of the calibers of the smaller bronchi is considerably greater than that of the trunks. The difference

is in regular gradation from the smallest to the largest tubes. On mechanical principles, therefore, the air, in expiration, has to pass more rapidly in the larger than in the smaller tubes. The rapidity is increased as the aggregate of the calibers. The rapid passing of the outward current of air through the bronchial trunks tends, of course, to convey the sputa along with the current, and thus relieve even the smaller tubes.

The death of a dying person is often hastened by the strangulating effect of the sputa, which he has not strength enough to eject; and when the vital powers are feeble but not yet overdone, the patient may sometimes be saved from death by being assisted in the matter of expectoration. This may be done by the timely administration of a stimulant, whether capsicum, brandy, carbonate of ammonia, or any thing else which is sufficiently diffusible and active in its effects. It may sometimes be done simply by a change of posture. Expectoration will be most easy in that posture in which the respiration is the freest; and that generally is the semi-upright. Local thoracic affections, however, call for different positions, according to their nature and circumstances. I have known a phthisical patient, for instance, whose life seemed to be prolonged for days and even weeks, by his sitting with his body nearly perpendicular, and with his head supported on something before him. In case of the existence of vitality sufficient to justify the measure, expectoration may be aided by creating emesis, and thereby calling the respiratory muscles into invigorated action, while at the same time the bronchial tubes are favorably affected. Of course, this is a case for the exercise of discriminating judgment; and some kinds of emetics will assist the efforts of nature much more than others. It is in this way only that young children can ever be made to expectorate, except the violence of coughing should sometimes force from their mouths a portion of the sputa.

As to the matter expectorated, we may often, from its appearance, judge of the nature of an existing disease. In health we expectorate nothing but a small quantity of thin glairy substance, called saliva. Any sputa different from that are the product of diseased action; and, by their mechanical and chemical qualities, we may often learn something — sometimes much —

of the nature and extent of the affection. The quantity, the color, the consistence, the form, the odor, all are mechanical matters to be taken into the account in making up our diagnosis from the sputa. Occasionally, too, it is desirable to test them chemically, as certain chemical properties are indicative of particular diseases.

The character of the sputa, in the several diseases which give rise to expectoration, and in the different stages of those diseases, will be pointed out as each pathological condition is described. At present I wish only to name and explain a general division of the matter which is ordinarily expectorated. This division classes the sputa as the *mucous*, the *albuminous*, the *watery*, and the *compound* kinds.

Mucus is a glutinous, semi-transparent or sometimes opaque matter, not coagulable by heat; and mucous sputa are more or less viscid, semi-transparent and colorless, or opaque and yellowish. They are produced by acute inflammation of the air-tubes or of the parenchyma of the lungs. The glutinous or ropy and semi-transparent sputa of the second stage of bronchitis are, perhaps, as purely mucous as any examples. In the third stage of bronchitis, the sputa are opaque and yellowish, — in the stage of hepatization in pneumonia they are rusty and exceedingly viscid, — and, in general, at an advanced period of inflammation they are thick and are not exclusively pure mucus. There is, so to say, an adulteration of the sputa, though they are essentially mucous.

Coagulated albumen is opaque, and the albuminous sputa are always opaque, and, in general, less viscid than the mucous. Of this kind are the fibrinous sputa of a form and stage of bronchitis, the simple prevalent sputa of phthisis, and those compounded of caseous and other matter united with the pus. This class of sputa indicates not an existing acute inflammation, but a state of suppuration. This state may have immediately succeeded acute inflammation, or it may be the result of tuberculous or scrofulous disease. Albuminous sputa consist of animal matter secreted and passing from the system.

Watery sputa consist of a thin liquid, which is water rendered slightly glutinous by the presence of a little mucous or albuminous

matter. It often assumes, in part, the form of froth. It appears to result from irritation of the air-tubes, together with a relaxed state of the secreting vessels, or from such a congestion of the blood-vessels and obstruction to the circulation as creates a degree of effusion.

The compound sputa are the products of different parts in different pathological conditions brought together, or of one part in such an intermediate pathological state as to secrete at once different kinds of matter. An example of this class is had in the muco-purulent sputa of chronic bronchitis and of phthisis. The coloring matter of the blood, in a diseased condition, may be mingled with other kinds of sputa. Thus in scorbutic patients, the sputa may compose a thin reddish-brown liquid, like prune juice ; and, in the last stage of phthisis, the pulmonary congestion preceding death may give a dirty or brownish tinge to the purulent sputa.

Other points of consideration, in the matter of the sputa, will naturally find place in the delineation of the various diseases of the thorax.

DIVISION III.

GENERAL TREATMENT.

According to the plan of Dr. Newton the general treatment of disease was to form the third division of the first part of this work. For some reason, unknown to me, this was omitted, and a description of particular diseases, forming the second part of the work, was commenced. In order to carry out his design, I write this article, in which, so far as I am able, I will embody those ideas of treatment which I learned while a student and an associate in teaching with Dr. Newton.

With reference to the principles of treatment of which many speak — I mean general principles, such as that termed "*similia similibus curantur*" — I would say, that to me they seem as yet destitute of that demonstrable proof which can be brought to corroborate the existence of the principle of gravitation. It is of no practical use, — because it leads directly to conjecture, — to theorize about the principle of life, the essence of disease, the vis medicatrix naturæ, and then to found upon unproved hypotheses a system of treatment. Enough of this kind of philosophy has already existed in the world, — a philosophy which is the bane of science and the enemy of improvement. On every side we meet with systems, or principles of treatment, of which the world of imposture and dupery contain the larger share.

Positive science is founded on facts ; it studies only phenomena, and the invariable law of their succession. Whenever we can discover the relations of phenomena, and their order of succession, then we can with certainty predict results ; and when we can do this, we can arrange circumstances, can prescribe medicines understandingly ; and know when remedial agents arrest the progress and check the violence of disease. Such knowledge is science, and its application, art. But owing to ignorance, we cannot, in general, attain to such precision in the prescription of medicine.

"Empiricism," says Dr. Hun, "is art founded on the observation of the relations of complex phenomena; scientific art is founded on the observation of the relations of phenomena as analyzed by science." The empiric, accordingly, prescribes for the symptom without looking for its cause, not seeking to learn the organic lesions, whether one or more; but the scientific physician prescribes, so far as possible, according to the nature of the lesion from which the symptoms arise. The empiric has a remedy which has removed a cough in several cases; therefore, he concludes that it will always do so. The scientific physician knows that cough proceeds from various lesions; sometimes from nervous irritability, in which case he would use an anodyne; sometimes from inflammation, in which case he would use relaxants, and nauseants and demulcents; sometimes from uterine sympathy, in which case he would prescribe remedies to restore the functions of that organ.

As I have often heard Dr. Newton remark, the more we can analyze phenomena, and the nearer we can attain to the ultimate lesion, or lesions from which symptoms arise, the more successful we can become in practice. To the attainment of such results, by the study of pathology, the profession has of late directed a large share of investigation. And while attention has been profitably directed in that direction, too little interest has been manifested in the discovery and use of more efficient and safe remedial agents. And, consequently, among the majority of medical men there is a tendency, after learning the inefficiency of the usual antiphlogistic regimen, to the adoption of a negative course of treatment, the only utility of which is, that it does no harm while it does no good. It is, however, an established fact that among the more liberal members of the profession there is now a tendency to the adoption of the safer remedies. The use of the lancet and mercury is becoming more and more limited, because common sense and science teach that it is not necessary to greatly reduce the vitality of the system in order to cure disease. Recent authors, among the most celebrated of whom is Dr. Carpenter, now contend that inflammation is not an *exalted* condition, as was formerly supposed, but that it is a depressed state of the vital force.

The adoption of this theory, which, it seems to me, is fully verified by facts, will produce a change in the practice of medicine; it will remove that false idea now so prevalent, that depletion by the lancet, by antimonials, and mercurials, is necessary in the removal of disease. Relaxation, effected by the use of water or its vapor, and by other sedative and relaxing agents, will reduce the frequency of the pulse and alleviate inflammatory symptoms, while at the same time the relaxation opens the excretory ducts, and favors the removal from the system of any superabundance of serum. This course of treatment relieves the symptoms, not by deadening the sensibilities, so that the effects of the disease cannot be felt, nor by taking away the blood, — the red corpuscles, fibrin and serum, the nutrient and the diluent parts together, thus impoverishing that fluid,—but it does it by exciting to action all those organs whose office it is to eliminate effete or poisonous matter.

The principle, the truth of which is self evident, was taught by Dr. Newton, that all remedial agents should be of such a nature as not to do injury in one way, while they do good in another. Cæteris paribus, those remedies are, therefore, best, which, while they tend to stimulate the diseased organs to the performance of their natural functions, and while they produce that state of the system most favorable to the free operation of the healing process, do not injure, by corrosion or otherwise, the textures on which they act. Such remedies it may be difficult to find, adapted to all circumstances and to all cases. For example, an emetic of lobelia might be indicated by the inflammatory symptoms, but be contraindicated by the existence of a hernia. But even here a medium course can be pursued; the production of catharsis and diuresis, or slight nausea in order to favor diaphoresis, will be admissible.

The treatment of disease may be divided into *prophylactic*, *curative*, and *palliative*. When it prevents the disease from occurring, it is then prophylactic; when it removes the existing disease, it is curative; and when, on account of the impossibility of its removal, we merely relieve the distressing symptoms, it is palliative. Medicine, in the treatment of disease, may be both curative and palliative. The remedies of this two-

fold nature are often applicable at the same time. While we use remedies to remove the disease, nervines and anodynes are sometimes efficacious in checking the violence of symptoms.

When we prescribe remedies according to general principles, and the treatment adopted is purely philosophical, it may with propriety be called *rational treatment.*

When we prescribe without knowing the why and the wherefore, without fully understanding the nature of the lesions from which symptoms proceed, and the qualities of the necessary remedies, then we act *empirically*, and the treatment may properly be called *empirical treatment.* [C.]

PART II.

PARTICULAR DISEASES.

DIVISION I.

DISEASES CONNECTED WITH THE PLEURAL CAVITIES.

CHAPTER I.

BRONCHITIS.

This disease consists in inflammation of the mucous or lining membrane of the bronchial tubes. The name is derived from the Latin, and also from our English word, *bronchus*, which is originally from the Greek, βρογχος. It is formed by dropping *us* and affixing *itis*. The term is sometimes employed to express inflammation of the trachea, the glottis, and the fauces, but such a use is extremely improper.

Bronchitis in its simple and marked form is a primary and acute disease.

Section I.

PRIMARY ACUTE BRONCHITIS.

Pathology.—Primary acute bronchitis is comparatively a mild disease, and not often, if ever, fatal. Of course, no opportunity is afforded directly to examine the anatomical lesions. It is judged of only by its analogy to cases in which the disease is secondary—to some graver and fatal disease. In those cases a *post mortem* examination often reveals every stage of acute bronchitis.

In them it is found that the mucous membrane is reddened and thickened. Its vessels are injected, and the part is indurated. Indeed, there is inflammation of essentially the same character as inflammation in any other tissue. The morbidly relaxed vessels

becoming over-distended, the blood is effused immediately around them; and, becoming stagnated and dead, discolors the part, sometimes producing ecchymosis. The inflammation, in this case, is more strictly limited to the tissue, than are inflammations of serous tissues. In the latter ones, the subjacent tissue is directly and principally involved, as the net-work of blood-vessels is spread out immediately beneath, rather than in the tissue. In mucous tissues the larger vessels lie, indeed, beneath the basal layer, but the smaller ones are traceable in the tissue above the basal portion.

In patients suffering under anæmia, inflammation of a mucous membrane gives it a pale rather than a distinctly red color. It loses the transparency of health, and becomes decidedly opaque. This variation from the ordinary appearance of inflammation is owing to the deficiency of red globules in the blood.

Stages of the disease. The stages of primary acute bronchitis are not very distinctly marked by anatomical characters or pathological changes. Indeed, writers have commonly made but two stages. I propose to make three.

I call the *first* the *incipient stage.* In it the inflammation produces a slight thickening of the mucous membrane. The *second* is the *progressive stage.* In this the membrane is more thickened. The *third* is the *developed stage.* In this the inflammation is subsiding, and the membrane is less thickened.

In this description I have just presented the pathological changes in the different stages of acute bronchitis. I would here add, that when bronchitis becomes somewhat chronic, suppuration and even ulceration may supervene. When complicated, too, with rubeola, or any like disease, the larger bronchial tubes may suppurate and ulcerate, even before the disease has been of very long standing. The reason is, such diseases so deprave and reduce the blood, that the vital action becomes deficient at an earlier period; but this classes the disease as chronic bronchitis.

Primary acute bronchitis may soon pass away, leaving the patient in his usual health; or it may pass into chronic bronchitis; or it may give origin to pneumonitis, and gradually subside as the pneumonitis increases; or by reducing vitality may even prepare the system for the development of phthisis.

Diagnosis.—*General symptoms.* The degree of fever and prostration of the system, and the state of the digestive functions vary, a good deal, in different cases of this disease. Sometimes the general disturbance of the system is very considerable, and sometimes it is very slight. Ordinarily, the patient has sensations of chilliness, especially at the earlier period of the attack. These are not constant, but pass away and return, perhaps frequently. Generally, there is considerable uneasiness in the system, and restlessness. The pulse is somewhat accelerated. It may be as high as 100 beats or more per minute, or it may be but little above the standard of health. In a majority of cases, it is not more than 80 or 90. It is comparatively soft, and is usually not very hard. It does not, indeed, indicate great debility, on the one hand, but, on the other, it does not possess great power. The respiration is generally somewhat hurried and shallow, though the departure from the normal standard is seldom very great. Usually the skin is rather hot and dry, though sometimes persons sweat freely. The tongue is apt to be somewhat dry; and it commonly has a thin whitish fur. Occasionally, it has a mucous coat of considerable thickness. Usually, this disease is not attended by pain in the thorax; but sometimes considerable soreness and slight pain, are felt, particularly at the time of coughing, in the region of the longer bronchial tubes. Probably, in these cases, the muscular tissue and perhaps some others, become involved in the inflammation, as the inflammation of mucous tissues alone, usually at least, does not give pain. Very commonly, the appetite is, in a good measure, removed; though sometimes it is but little disturbed. When the stomach is considerably affected, there is frequently, also, considerable headache. This may result through the nervous system, or by means of congestion of the cranial blood-vessels. Such are the more prominent general symptoms.

The *special symptoms* vary according to the stages and severity of the disease.

In the *first stage*, the sound of respiration is rather diminished, but its two elements generally remain in normal proportion. If, however, the inflammation affects particularly the smallest bronchial tube, it may, also, involve the vesicles, or prevent the full

ingress and egress of air, so as somewhat to lessen the vesicular sound. This diminution of the respiratory sound or of one of its elements is confined to such portions of one or both of the lungs as happen to be affected. It is generally most appreciable somewhere anteriorly; and in the progress of the disease, varies somewhat the place of its manifestation. Percussion affords but a negative evidence of the affection, as the resonance of health remains. The ordinary mucous secretion is, in a good measure, or entirely suspended. Of course, there is little or no expectoration; and this is the principal characteristic of this stage. The cough is dry; but it is hard and hoarse,—a hard barking cough.

In the *second stage*, in very mild cases, the respiration has only a peculiar roughness and seems even stronger than the respiration of health; but, in cases of any severity, the sonorous rale exists, and occasionally the sibilant. The former being almost exclusively made in the large bronchial tubes, is heard the most loudly directly anteriorly or posteriorly to the roots of the lungs. The latter, if it exists, is heard principally in immediate proximity to the smaller tubes, in which it is principally made. The sonorous rale, when heard, is pathognomonic of this stage of bronchitis. It can be created by no other condition of disease. Percussion gives the normal resonance, with the exception, that there is a slight degree of dullness, when the inflammation has extended to the smallest bronchial tubes and the air-cells. The secretion of mucus, in this stage, has returned; but it is thin, stringy, semi-transparent, and glairy, in appearance, and copious in quantity. The expectoration, of course, is quite abundant, and the cough is loose and frequent.

In the *third stage*, the inflammation is lessening, and the mucous secretion and expectoration are still free. The sputa are thick, yellow, and opaque, but not very tenacious. Their increased consistency, yellowness, and opacity indicate an approaching resolution of the disease. The mucus in the larger and medium-sized bronchial tubes causes the mucous and sub-crepitant rales, in those two classes of tubes respectively. Percussion is still resonant. The cough, too, remains frequent, but it is even more loose than in the second stage. It is also characterized by a *softness*, produced by the lubricated condition of the tubes.

In the mildest forms of primary acute bronchitis, the characteristic sputa of the third stage sometimes scarcely appear. Again, where those sputa, to some extent, are observed, the characteristic rales take place but slightly. The respiration gradually returns to its normal state,—the sputa not being sufficient to produce, to much extent, their peculiar effects. Sometimes, in this disease, when the inflammation is considerably extensive and intense, palpitation affords evidence of its existence. The air-passages being obstructed and the air passing with difficulty, a portion of the chest is agitated by the respiration, and the vibration is felt under the hand.

In general, this disease is readily distinguished from all others. It has some relation to pleuritis; but the special and the general symptoms are too different to be confounded, as a comparison of one class with the the other will show. The lancinating pain in pleuritis, the absence of expectoration, the dyspnœa, the degree of fever, &c., are symptoms very different from any exhibited in bronchitis. The symptoms of pneumonitis more nearly resemble those of bronchitis; but the expectoration in these two diseases is very different. The crepitant rale, too, of the first stage of pneumonitis and the shrill bronchial respiration of the second stage do not belong to bronchitis. The prostration from fever is, likewise, much greater in the former disease than in the latter. It is common, however, for inflammation, commencing on the mucous membrane of the bronchi, to pass on and reach the parenchyma of the lungs; so that pneumonitis often has its origin in bronchitis, and some slight degree of the former may combine with a severer degree of the latter, without being appreciable. Pertussis, which is a modification of bronchitis, does, indeed, at its commencement, resemble the simple affection; but the whoop, the general character of the cough, &c., will generally enable us to discriminate between the one affection and the other. A very common *cause* of primary acute bronchitis is exposure to cold and wet combined. An obstruction to capillary action on the surface and to perspiration, is produced, the circulation is disturbed, the vessels of the mucous membrane of the bronchi become congested, and inflammation is set up. The inhalation of noxious vapors and of par-

ticles of dust, whether mineral or vegetable, may be an accessory or even the primary means of developing the disease.

Prognosis.—The prognosis of primary acute bronchitis is generally favorable. Ordinarily, what danger there is arises, partly perhaps from an immediate effect produced on the nervous system, but more from the fact that access of air to the vesicles is measurably prevented, and the blood is not properly arterialized. Sometimes, bilious and gastric symptoms complicate those of bronchitis; but they are seldom of so grave a character as to add much to the danger attending the disease. In aged persons, however, the vital powers are less vigorous than at the middle period of life. Of course more constitutional disturbance is created with them, depuration and expectoration are not so vigorously maintained, and the system is necessarily more prostrated. This is sometimes called asthenic acute bronchitis. The greatest danger, however, arises from the liability of the disease to terminate in pneumonitis, —the latter affection being frequently too grave for the debility of advanced life to withstand. In young children, there is a similar liability, but evidently from some different cause, though precisely what that cause is it is difficult to understand. Certain it is, that the liability, on the part of the areolar tissue of the lungs, to take on inflammation, adds very much to the danger attending bronchitis in young children.

Treatment.—The treatment of primary acute bronchitis is very simple. The indications to be fulfilled are to promote the ordinary secretions generally, and especially the perspiration, to equalize the circulation, and particularly to excite free expectoration.

Towards fulfilling these indications, an emetic of lobelia inflata is useful in equalizing the circulation and promoting perspiration; especially, if the stomach sympathizes and the appetite is destroyed. If an emetic is to be given, this may as well be done in the first instance. Soon after the emetic, or, at an early period of the treatment, if the emetic is omitted, a simple cathartic should be administered. For this use, nothing is better than the leptandria virginica. It may be given in a decoction, or in a semi-liquid extract; or the solid extract may be used, being made into pills

with the addition of a little pulverized capsicum baccatum. Beach's common purgative or anti-bilious powder is also very good. This may be given in decoction or in a semi-liquid extract.

But the two principal things to be done, are to produce perspiration and to excite a free expectoration.—To accomplish the former, the vapor bath or the pack sheet may be resorted to, if the case is severe enough to call for it; but, in ordinary cases, the vegetable composition, and the common diaphoretic and anti-febrile powders are fully sufficient. I prefer in combination, the diaphoretic and the antifebrile powders, the formulas of which are given in this work. Let the common dose be given every four hours, or from four to six times a day. [I usually find it more convenient, and more agreeable to the patient, to take a pill of extract of lobelia, instead of the anti-febrile powders, once in four hours, alternatively with some diaphoretic powder. Or, if it is desirable to give the medicine in powder, the extract may be triturated with loaf sugar, and given in that form. The free use of gum acacia and licorice water will be found serviceable. Dr. Gabbert uses but little expectorant medicine in this disease, but depends almost wholly for the cure upon emetics and nauseants. After the fever is subdued he uses quinine freely. C.]

As an expectorant, nothing excels the compound syrup of sanguinaria and lobelia. It may be given in doses of from half a dram to a dram, every two hours; or be alternated with the dose of diaphoretic and anti-febrile powder, and be given every four hours. In a majority of cases, the compound syrup mentioned above, given every two or three hours, in doses as large as can be borne without emesis or essential nausea, will effect a cure, in a short time.

Section II.

SECONDARY ACUTE BRONCHITIS.

Ordinarily acute bronchitis, as we find it, is a primary or idiopathic affection; and this, as we have seen, may be complicated with some other disease, arising either from the same or from a different cause. Secondary acute bronchitis, however, is an acute

inflammation of the mucous membrane of the bronchi, induced by the existence of some other disease, which has previously set in and which still continues. This other disease may be an acute affection as typhoid fever, measles, or almost any one of the exanthematous diseases; or it may be a chronic affection as emphysema, phthisis, or even some cardiac affection. Even chronic bronchitis may assist in giving a new development to the acute disease, which thereby becomes secondary to the chronic. Generally, in this latter class of cases, the dyspnœa, and distress are much more severe than in the primary form of the disease; and, in some cases, the vital powers may be so much embarrassed as to render the prognosis unfavorable.

The *treatment* of secondary acute bronchitis is essentially what is adopted in the primary disease, as the indications of cure are essentially the same. Expectorants and diaphoretics are the leading remedies. Emetics, laxatives, and diffusible stimulants may sometimes be required. Sinapisms and other stimulants, applied externally, particularly upon the anterior portion of the thorax, sometimes aid considerably in effecting the cure. Cold wet cloths, especially, are of great service.

Section III.

CHRONIC BRONCHITIS.

In strictness, chronic bronchitis is nothing more than a continuation and modification of the acute disease; or the former may be said to have its origin in the latter.

Pathology.—When inflammation is not soon resolved, generally ulceration supervenes. This is a breaking down of tissue, and a manifestation of that imperfect character of the reparative process, which is attended with suppuration. In the case of the mucous membrane of the bronchi, when this change takes place and continues for some length of time, acute bronchitis is said to be converted into chronic. Seldom, if ever, does the ulceration extend to the minute ramifications of the tubes; but it affects mainly the larger bronchi, in connexion with the trachea and the

parts still higher. It seems inclined to seize first, on the follicles; but those most fully developed and best fitted to receive inflammation, are situated in the larger passages. From these follicles, the ulceration sometimes extends, with an irregular outline, and involves the membrane immediately around.

Such being the anatomical character of chronic bronchitis, it, of course, is incapable of being divided into stages.

Ordinarily, the preceding acute disease is, for a time, very manifest. Sometimes, however, the symptoms of chronic bronchitis develop themselves gradually, so that its origin is not generally referred to the acute disease. In this case, inflammatory action has previously been going on, slowly and almost imperceptibly, but yet so as to bring about the same results as when it has been more rapid. This clandestine progress of the disease is confined almost exclusively to persons in advanced life. In middle age, in a form at all marked, it is very rare; and, in children, it is unknown.

Diagnosis.—In chronic bronchitis, the sputa and the cough vary considerably according to incidental circumstances. Generally, the sputa consist mainly of thick, whitish or yellowish mucus; but this is often mixed with purulent matter, the result of suppuration and ulceration. Sometimes, however, the matter expectorated is thin, glairy, and semi-transparent. The existence of this form of the sputa is indicative of a complex anatomical condition, and not one of mere chronic bronchitis. The air-cells are somewhat dilated, constituting a degree of emphysema; and this gives rise to the peculiarity of secretion. Sometimes, the expectoration is almost wanting. This condition is produced by such a thickening of the mucous membrane as prevents its discharging its proper office, that of secretion; consistently with this condition the air-cells may be somewhat dilated.

The cough in chronic bronchitis is generally loud and hard. In the second condition named, it is generally harder than in the first; but, in both, it is somewhat loose. In the third condition, the cough is dry and short, but still it is comparatively strong.

The constitutional excitement in chronic bronchitis is never great, and is generally very slight. In the first variety specified,

when there is a considerable discharge of mucus and pus, the febrile symptoms are sometimes quite decided.

As physical signs, we have, in the first variety, the mucous and the sub-crepitant rales, produced by the muco-purulent matter in the larger and the medium-sized bronchi. The respiration is sometimes quite strong, but oftener feeble. Percussion is normal.

This form of bronchitis is distinguished from phthisis, to which it has some resemblance in symptoms,—mainly by the absence of dullness or percussion at the summit of the lungs, and of bronchial respiration at the same part, cavernous respiration, and other signs of the latter affection. It is apt, however, to terminate in phthisis, by preparing the way for the introduction of the latter disease.

The second variety generally comes on gradually, not being preceded by any marked degree of the acute affection; but, when fully developed, it is manifested by the existence of different rales, in different parts of the thorax, at the same time. We sometimes hear the sonorous, the sibilant, the mucous and the sub-crepitant, simultaneously. Laennec called this music, "cantus omnium avium," "the song of all the birds." Generally, the tubes of medium size are more affected than the larger; and hence the sibilant and the sub-crepitant rather have the predominance over the sonorous and the mucous. We may hear, at one time, a portion of these rales, and not the whole. For instance, before there is much secretion, inflammation having quietly progressed to a certain extent, we may hear the sonorous and the sibilant, which sometimes rule; also, a sound intermediate between these two, or a compound rale; and afterwards, we may have the humid, that is, the mucous and the sub-crepitant, which, also may in character, approach each other. But the disease may have advanced farther in one portion of the tubes than in another,—the secretion having taken place freely in one, while another is still turgid and dry; and this condition may be such as to give rise to the simultaneous existence of the dry and one of the humid rales,—as the sibilant and the sub-crepitant, when the affection is upon the medium sized bronchi, or the sonorous and the mucous, when the larger tubes are the seat of the disease.

In this form of the disease, there is commonly some dyspnœa.

If there is, to any extent, an emphysematous condition of the air-cells, it will be somewhat severe, considerably simulating asthma. So, too, when the thickening of the tubes essentially obstructs the passage of air through them, the resemblance to asthma will be even greater. Percussion is normal.

In the third variety, the respiration is usually feeble. The sibilant and the sonorous rales are heard, whenever the thickening of the tubes is sufficient to produce them. In other cases, they are wanting. Percussion is normal throughout the thorax; or, not unfrequently, unnaturally resonant, on account of the existing emphysema. Sometimes one of the adventitious sounds, the emphysematous crackle, is heard, in consequence of the rustling of the air-cells against one another or against the pleura.

On the whole, the varieties in the symptomatology of chronic bronchitis are due, partly to incidental matters and different stages of the disease, and partly to its complication with another affection.

Prognosis.— In the first form of chronic bronchitis, the chances for entire recovery, under proper treatment, are good. With improper treatment, it may prove fatal. In the other forms, the disease may be expected to continue, with temporary abatements in the symptoms, while life lasts. Unless, however, it becomes complicated with other serious affections, it is not apt to bring life to a hasty termination.

Treatment.— In the first variety, the indications to be fulfilled are quite similar to those of the acute disease. In severe cases, I have found great benefit from the repeated use of vapor baths and emetics. They equalize the circulation, and induce a healthy action on the surface. This necessarily diminishes the irritation and represses the morbid action of the lungs. At the same time, however, expectorants to promote a healthy action of the secreting follicles of the bronchi, are of great service; and nothing serves the purpose better than the compound sirup of sanguinaria and lobelia. Of course, the alvine discharges and all the secretions should be kept free.

But notwithstanding the liability to febrile excitement in this form of disease, the constitution often needs sustaining with

some simple vegetable tonic, as the common spiced bitters, quinine or salicine. In one very aggravated case, I used the vapor bath and an emetic, every other day, for ten days; and, for intermediate treatment, I gave an expectorant and tonic in connection. When I commenced the treatment of the patient, he expectorated from one to two pints of muco-purulent matter daily. At the expiration of ten days, the symptoms were greatly abated; and, by continuing the expectorant and tonic treatment alone for two weeks longer, he was restored to health, and has continued well to this day.

Local applications to the chest are sometimes serviceable. Wet cloths will absorb morbific matter; and, if there is any active inflammation, they will aid in allaying it. Occasionally, when the vital powers are not very active, I have found a decided benefit from the use of an irritating plaster, anteriorly, over the superior lobes of the lungs, or on the spine, over some of the last cervical and first dorsal vertebræ. For this purpose, Dr. Hill's irritating plaster may be employed; or one may be made by mingling pulverized podophyllum peltatum with common shoemaker's wax, Burgundy pitch or almost any adhesive material. This treatment is best suited to those lingering cases, which endanger the inducing of tuberculous disease, in these cases, too, inhaled vapor, properly medicated, as with rosin, ether, or the like, is sometimes of service.

In the second and the third forms of chronic bronchitis but little benefit is to be expected from medication. Of course, mild expectorant and some general constitutional treatment will be of some service. [In these cases the occasional use of emetics and the vapor bath, as Professor Newton has suggested, is the best course of treatment. Professor Gabbert, to these means adds the use of astringents, such as bayberry and hemlock. In the intervals between the administration of the emetics and baths, the compound lobelia pills should occasionally be given, in order to promote capillary action and favor expectoration. Tonics when used in conjunction with these pills will seldom excite febrile action. A nourishing yet unstimulating diet should be used, and the benefits of a pure dry atmosphere, and of gentle exercise, should be sought. C.]

Section IV.

BRONCHITIS OF CHILDREN.

The bronchitis of children is primary acute bronchitis modified by some peculiarities of constitution on the part of children. One modification is its decided tendency to be converted into lobular pneumonitis. Whether this tendency is to be ascribed to the delicate structure and comparative weakness of the air-cells in children, in connection with the strong respiratory action which takes place with them, or to the fact, that children do not, like adults, expectorate to relieve the air-passages, so that the smallest tubes and air-cells become specially oppressed, does not certainly appear. Another modification is the early period at which a copious secretion takes place, either preventing the existence, or causing the early disappearance of the dry rales, so that they do not fall under observation. On account of the amount of mucus which loads the tubes, the mucous and the sub-crepitant rales are abundant almost throughout the continuance of the disease. Percussion is generally normal, though sometimes a little dull, on account of the accumulation of mucus in the smaller tubes and an accompanying congestion of the blood-vessels in the lungs. Of course, there is a loose cough and some degree of dyspnœa. There is often considerable constitutional disturbance, and not unfrequently cerebral symptoms. The whole face is sometimes flushed, and the color is a purplish red, on account of the blood's being imperfectly aerated.

The *treatment* of this form of bronchitis consists essentially in the use of emetics, expectorants, and diaphoretics. Emetics and nauseating expectorants are the more necessary, for the reason, that children do not voluntarily expectorate. With them, it is mainly during the process of vomiting, that the mucous secretions are ejected from the air-tubes. The antifebrile character of the treatment will, of course, be proportioned to the amount of febrile excitement; and, in general, regard must be had, according to circumstances, to the preservation of a healthy operation of the various functions.

[In treating the bronchitis of children, great care should be taken to produce a free cutaneous secretion. On account of the difficulty, always experienced by them in taking medicine, the use of external means becomes the more necessary. The warm bath, should, therefore, be frequently applied; and in its application these cautions should be observed:—To have the temperature of the room above 80°, to immediately wrap the child in warm flannels, without exposing its body to the contact of air, and thereby cause a chill, and to let it remain quiet in bed in order to promote perspiration. After a proper degree of strength is obtained to render reaction certain, the sponging of the chest in salt water a little below the temperature of the body, will fortify the system against a relapse. C.]

Section V.

EPIDEMIC BRONCHITIS.

Epidemic bronchitis, commonly called influenza, is primary acute bronchitis, attended with febrile symptoms of decidedly greater intensity than accompany the ordinary form of the disease. The physical signs, in one case, do not differ essentially from those in the other. The character of the cough and the degree of the dyspnœa, in the two cases, are essentially the same; but in influenza an epidemic and irritative influence is felt, the nature of which is much like that which produces common continued fever. Of course, while these are the special signs of acute bronchitis, they are also, to some extent, the general signs of continued fever.

The *treatment* superadds to that which is proper for the simple disease, a measure of those more decidedly antifebrile means which are adapted to ordinary cases of fever. As far, too, as the liver, the stomach, and other abdominal organs become implicated, they require attention in kind much the same as is demanded by continued fever. Epidemic bronchitis, however, is seldom a very grave disease. The *prognosis* is almost always favorable.

Section VI.

BRONCHITIS OF OLD PEOPLE.

The bronchitis of old people is only chronic bronchitis, in an asthenic form, in consequence of the diminution of vital influence on the part of those who are the subjects of it. It has received various designations. It has sometimes been called *catarrhus senilis — the catarrh of old people;* but the term *catarrh*, from Κατα, "down," and ῥεω, "I flow," ought to be limited, in its application, to inflammatory affections of the nares, fauces, &c., and not to be extended to those of the bronchi, from which the discharge is *upward* to the throat and mouth. Again, it has been called *peripneumonia notha — bastard* or *spurious peripneumonia. Peripneumonia* is a compound word from περι, *about*, and πνευμων, *a lung. Notha*, from νοθα, signifies *bastard* or *spurious*. When the nosological classification of diseases prevailed, and their pathology was not much understood, the term was understood to signify a collection of symptoms much like the following:—difficulty of breathing, oppression at the chest, obscure pains, a cough, and an expectoration Of course, these symptoms might vary considerably in the degree of their severity, and yet be understood to characterize one disease.

The bronchitis of old people, properly so called, is usually attended with a considerable amount of mucous or muco-purulent discharge, and not unfrequently with passive congestion of the pulmonary blood vessels. When the inflammation mainly attacks the smaller tubes, it is said to stimulate pneumonitis; but the truth probably is, that, when there are symptoms decidedly like those of pneumonitis, the parenchyma of the lungs is not only congested, but measurably involved in inflammation, properly so called. This, of course, as vitality with the aged is more or less reduced, depresses the system and produces considerable constitutional disturbance. The aged, too, are very subject to a degree of emphysema; and when this complicates bronchitis, it aggravates the symptoms. To crown all, the patient may *take cold*, and superadd new inflammation or acute

bronchitis to the chronic; and then, of necessity, the symptoms will be severe.

In some cases there takes place, in the bronchitis of old people, a kind of semi-fibrinous secretion, of the same nature as that which takes place in the trachea, and sometimes in the bronchi, in the *bronchitis* of children. It is somewhat like the hyaline secretion of inflamed serous membranes, but it is only imperfectly, if, indeed, it can be said to be at all, organized. Such a secretion blocks up the tubes, and prevents the passage of air to the air-cells. It, consequently, produces great dyspnœa, or even orthopnœa, and much general prostration of the system. When this secretion exists, it may be detected in the sputa.

The *treatment*, in this form of disease, is essentially like that in chronic bronchitis generally; but the asthenic condition of the patient requires that stimulating tonics, especially those of the vegetable kind, be, to a greater or less extent, combined with the emetics, expectorants, and diaphoretics employed. The polygala senega is a good remedy, as it combines expectorant with stimulating tonic properties. As a rapidly diffusible stimulant, too, the carbonate of ammonia is good, to sustain the vital powers. Sinipisms, or other external stimulants, will sometimes assist in allaying the inflammation and arousing a healthy action; and sometimes properly medicated vapors may be of service. In general, however, the compound sirup of lobelia and sanguinaria in connection with vegetable composition, spiced bitters, capsicum baccatum, &c.,—constitutional conditions being attended to—will be all that is necessary.

Section VII.

GENERAL REMARKS.

Bronchitis, either as an acute or as a chronic disease, is occasionally dependent on some peculiar diathesis, or the introduction of some specific virus into the system. Thus, a person of a scrofulous habit is, on that account, the more liable to have chronic inflammation of the bronchial, in connection with the same kind of inflammation of the superior portion of the respira-

tory tubes, the nasal cavities, &c., and there will be, in this case, a copious secretion of thick glairy mucus. Persons subject to attacks of erysipelas or psoriasis will sometimes have acute bronchitis developed, in consequence of the tendency of the eruptive diseases to affect the mucous surface of the air-passages much in the same manner as they ordinarily do the cutaneous surface. The same is eminently true of rubeola, variola, &c. A syphilitic taint in the blood will sometimes produce chronic bronchitis, the symptoms of which are very similar to those of phthisis. The discharges from the bronchi are muco-purulent; the system becomes emaciated; and the constitutional disturbance is serious. Indeed, this affection does much to prepare the way for the actual development of phthisis.

In all the forms of bronchitis, the object of nature in the mucous secretion generally is to relieve the congested and inflamed vessels. The discharge is excretory. This object, therefore, whatever may have given rise to the disease, may be aided by artificial means. Equalizing the circulation and promoting the perspiration also tend to the same effect. If this object is not secured, either by nature or by art,—if there is little or no discharge from the bronchial tubes and from the skin, the tendency is for the heart to become congested and the vessels of the lungs to become distended, giving origin to cardiac dilatation and pulmonary emphysema.

Sometimes, however, the secretion continues, without an abatement of the inflammation. In this case, the discharge is a morbid one. The mucous tissue itself seems to be in a morbid condition, so that its secretory follicles act abnormally and do not relieve the blood of those ingredients which keep up a morbidly-relaxed and over-distended condition of the vessels. These, of course, are the cases in which, particularly, tonics and stimulants are indicated in connection with expectorants, for the purpose of sustaining a healthy action of the mucous follicles.

CHAPTER II.

PERTUSSIS.

Pathology. — I reckon *pertussis*, or *whooping cough*, as a thoracic disease, although the affection is not confined exclusively to the bronchi. Superior portions of the air-passages are also involved. The disease is often ranked as a variety of bronchitis; and inflammation of the bronchi does constitute a portion of it, but does not the whole. It involves, also, an affection of the nervous system, producing a spasmodic stricture of the bronchi and the trachea, and especially a spasmodic closure of the glottis. The degree of inflammation and of spasm varies,—both may be severe, or both mild; or they may be united in different proportions, the one or the other predominating.

Pertussis is a contagious disease, caused by a specific virus, conveyed from one person to another, by the atmosphere. As the disease is common in every community, and yet is not ordinarily repeated with the same individual, few persons escape it in childhood, and it is confined almost exclusively to that age. It has, however, been said to occur even in advanced age with those who have escaped it in earlier life. As far as the disease consists in inflammation, it is like that of ordinary acute and chronic bronchitis. The spasmodic condition of the tubes, however, commences before the inflammation; and there is a secretion of whitish mucus which accumulates, especially in the smaller bronchi, before any redness or thickening of the mucous membrane appears. But, after the disease has existed for a season, the bronchi become reddened and thickened, and then they are filled first with a yellow *mucus*, and afterwards with a yellow *muco-purulent* liquid. The accumulation of the contents of the tubes, particularly in the inferior portions of the lungs, tends gradually to enlarge, and often does enlarge, these tubes. It sometimes results in their permanent dilatation. In some other cases, the obstruction of the smaller tubes leads to the enlargement — temporary or permanent — of the air-cells. Occasionally it would seem that the inflammation of the tubes induces diphthe-

ritis, and, not unfrequently, the inflammation extends to the parenchyma of the lungs, at least to some of their lobules; and then, of course, it is complicated with pneumonitis,—generally of the lobular kind. One other complication is liable to occur. The paroxysms of coughing obstruct the circulation of blood through the lungs, and thereby congest the brain. The congestion is sometimes so great as to rupture the blood vessels, producing apoplexy, convulsions and death.

Diagnosis.—The febrile symptoms in pertussis, unless it becomes complicated with lobular pneumonitis or some other grave disease, are not usually great. There is not great heat of the skin; not much excitement of the pulse. At first, the symptoms are liable to be taken for those of primary acute bronchitis. At this time the cough is not very peculiar. There may be some feeling of constriction in the chest and of weight in the head. Sometimes there is a swelling of the tissues about the eyes; they themselves are inflamed, and there is a propensity to snoring and the discharge of tears. The sputa, at first slight and viscid, become, as the disease advances, more copious and less tenacious.

The peculiarity of the cough, however, appears the most important evidence of the disease. It is found in a series of rapid forced expirations, followed by one long and loud inspiration, the shrill character of which is produced, not so much in the bronchi, or even in the trachea, as in the larynx or glottis. The epiglottis recedes, as if by the relaxation of a spasm, and the exhausted lungs are filled by a single inspiration. Instantly a series of expirations similar to the former commences, and this is followed by an inspiration like the preceding. This process is usually repeated several times, until at length a free expectoration of mucus occurs, and the paroxysm ends. The patient, exhausted and perhaps frightened by its violence, while existing, soon recovers his strength and spirits, and continues as cheerful as before, until a return of the paroxysm.

As a paroxysm is approaching, generally some warning of it is had in a sense of chilliness on the surface, of tickling in the throat, and of tightness in the larynx and air-tubes. This induces the sufferer to lay hold on something for support, or to fall on the

ground for relief. In severe cases, the sense of suffocation is great, the respiration is much impeded, the features are swollen and livid, the eyes are strained, and tears are copiously shed. The paroxysm is protracted; but, as soon as it closes, the patient is essentially relieved, for that time, though some constitutional symptoms may remain. During the paroxysm, rarely hæmoptysis, but not unfrequently epistaxis occurs. In young children, sometimes, fæcal and urinary discharges will involuntarily occur. Temporary asphyxia is not uncommon, and, in some instances, this has proved fatal. This peculiarity, it should be here remarked, does not show itself until the cough has existed for several days, —often for a week or more. In the onset, the attack seems like one of primary acute bronchitis. The paroxysms of whooping, after they have commenced, are repeated, sometimes at periods of fifteen or twenty minutes, and sometimes much less frequently,— in many cases not returning more than six or eight times in the course of a day. When there is much congestion of the brain, and, of course, a liability to apoplexy, the paroxysms of coughing are attended with a flushed countenance, turgid jugular veins, chemosis, and sometimes epistaxis. In such cases, too, the patient will seem inactive and drowsy, the head will be specially hot, and there may even be a starting in sleep, and a grinding of the teeth.

In this disease, we sometimes have the *cantus omnium avium*, or the sonorous, the sibilant, the mucous, and the sub-crepitant rales. A copiousness of secretion early takes place, giving rise to the humid rales; and yet portions of the tubes remain in such a state as to continue to produce the dry rales also, especially the sonorous. The manner in which I suppose the last to be made I have previously pointed out. I will here add, that, in this disease, we sometimes get a tone intermediate between these two sounds, as they are heard in their marked forms; and the mucous and the sub-crepitant approach each other. Of course, if the disease leads to other lesions, and becomes complicated with them, the distinctive rales and other indications of those lesions will appear. In general, after a paroxysm of coughing has relieved the bronchi of their contents, the respiration is tolerably free and expansive, till an accumulation has again taken place. This is

more particularly true at the earlier period of the disease. After inflammation has essentially modified the condition of the tubes, the respiration may be modified and feeble.

Percussion, in pertussis, is usually about normal. In case of some enlargement of the bronchi or the vesicles, the resonance can hardly be perceptibly increased, though, when there is induration of the lungs, to any extent, percussion may become somewhat dull.

The *recognition* of pertussis is generally easy, by the existence of the *whoop*, particularly, and by other peculiarities after the lapse of a week or two from the time at which the cough commences. Usually, this *whoop* characterizes the cough for about one month; at the expiration of which time it essentially ceases; and after about two weeks more, the cough itself is mainly gone.

Ordinarily, the *whole continuance* of the disease is about eight weeks; but it is protracted to twelve weeks or more. An attack of acute bronchitis will prolong its existence, and even return the *whoop*, after it has ceased, for a week or two to be heard.

The *prognosis* in the simple form of pertussis is favorable. It is only when some of the complications already referred to occur, that the case becomes one of danger.

Treatment.—The indications to be fulfilled, are to eject the matter secreted and accumulated in the air-passages; to allay the spasmodic excitement; and to *resolve* the inflammation.

To accomplish the first object, remedies will sometimes be found necessary, especially when the accumulation is considerable and the constitutional disturbance is serious. Ordinarily, however, expectorants, freely taken, will accomplish all that it is desirable to do, in this particular. To answer the second object, antispasmodics are required; and, for the third, diaphoretics and relaxants are indicated.

To fulfill all these ends, especially the two former, the compound sirup of lobelia and sanguinaria is admirably adapted. Indeed, in at least four cases out of five, an ordinary dose of this, administered at periods of from two to four hours, will be all the treatment that is essential. If the febrile symptoms should, in any case, be considerable, an ordinary anti-febrile or diaphoretic

powder may be employed. A dose may be given intermediate between the doses of the expectorant, or at the same time, at pleasure.

Dr. W. Beach recommends the following expectorant:—Sirup of squills, wine tincture of ipecac, and sirup of white poppy, employed in equal parts. Of this a dose is from one to two teaspoonfuls, repeated as required. This, however, is an agent far less valuable than the one above recommended. There is, in lobelia and sanguinaria, sufficient anti-spasmodic and sedative power, for the treatment of all ordinary cases. If, however, a decidedly narcotic article seems at any time desirable, the atropa belladonna is unquestionably the best article to be employed. It may be given in the form of an extract or a tincture. The dose of the extract is from one sixth to one twelfth of a grain for a child two years of age, to be given two or three times daily, and to be gradually increased, till a grain or more is given daily. Of the tincture, an equivalent quantity should be taken; but, being variously prepared, it differs materially in the degree of its strength. The dose may, therefore, vary from five to eight or ten drops. I prefer the extract; and I recommend dissolving a small quantity in the compound sirup, and so administering it, with that sirup, in doses of from a twelfth to a twentieth of a grain.

Gentle aperient medicines should be given, if necessary to regulate the bowels, and all the secretions should be kept in a good condition.

In the later period of the disease, the energies of the system having become somewhat reduced, it is sometimes desirable to combine some bitter tonic with the expectorant employed. In such cases, a fourth of a grain of quinine or half a grain of salicine may be united with the dose of the compound sirup, to be given several times a day. Or one or two drams of the decoction, or the infusion of hydrastis canadensis, populus tremuloides, cocculus palmatus, or some similar bitter tonic, may be given in connection with the compound sirup. I have, however, seldom found any tonic necessary or desirable. If the proper expectorant, anti-spasmodic and anti-inflammatory treatment is sufficiently early and vigorously pursued, it will so far meliorate and shorten the disease, that the vital energies will not often be much impaired.

By some practitioners, the *macrotys racemosa* has been highly extolled, as a remedy for pertussis, suited to all periods of the disease. It possesses alterative, expectorant, nervine, and slightly tonic properties; and these cannot fail to render it serviceable. It may be given in the form of an infusion, a decoction, or a tincture. The saturated tincture is, for administration, the most convenient of these forms; and, of such a tincture, the dose is fifteen or twenty drops, every four or six hours, for a child of two years. The *macrotine*, however, which is the *resinoid principle* of the crude article, is decidedly the best preparation. Of this, to a child of two years, one fourth of a grain may be given every four hours.

Counter irritants applied over the lungs, anteriorly, have been recommended; but they are seldom necessary, scarcely, if ever desirable. They have, also, been thought serviceable, when applied between the shoulders, over the spine, posteriorly. Their effect, in the latter position, is to stimulate the action of the nerves connected with the function of respiration. This may, sometimes, be favorable; but it is not so much an increase of respiratory power as an allaying of the spasmodic tendency, that is wanted. Accordingly, it is not so much a stimulant as an anti-spasmodic, which is required. Hence, a plaster made of the extract of belladonna, and applied between the shoulders, will alleviate the symptoms far more than any mere stimulating application. Indeed, a plaster of this kind is often decidedly beneficial.

[Dr. Gabbert speaks highly of the following compound for the cure for pertussis:—Molasses, and sweet oil equal parts, tincture of lobelia one fourth part. To be administered like the common expectorant sirup. C.]

CHAPTER III.

ASTHMA.

Pathology.—Asthma, in Greek ασθμα, literally signifies a gasp for breath, or a deep, heavy, laborious breathing. The term, however, by professional consent, is now limited to a disease which consists essentially in a spasmodic constriction of the bronchial

tubes, but is attended with great dyspnœa, more or less paroxysmal, and a secretion of thick viscid mucus. From the nature of the case but little can be said of the pathology of the disease. It is strictly a neurosis. The evidences that the bronchial tubes are spasmodically constricted are sufficiently strong. In the first place, the apparent absence of an inflammation, or other appreciable lesion favors the belief that the difficulty must be nervous. Again, its paroxysmal character forbids the supposition of any marked or permanent change wrought in the structures, but clearly indicates something of the nature of spasm. Then, too, the patient has a sense of constriction in the chest, very similar to that of *cramp* in the limbs or other portions of the body; and, sometimes, the attack is actually accompanied by ordinary manifestations of cramp. Still further, the patient experiences the effects of nervous irritability,—such as great flatulence, and a urinary secretion like that produced by hysteria. The *lædentiæ* and the *juvantia*, too, indicate the same thing,—the attack being produced by almost any cause of irritation, even by mental suffering, and being relieved more or less, by all anti-spasmodic agents. And, finally, the beneficial effects of galvanism, which not only strengthens weak nerves, but relieves the irritable, corroborates the same view.

That the mucous membrane of the bronchi sometimes suffers inflammation, during the continuance of the disease, is unquestionably true ; but this is to be regarded, rather as a complication of bronchitis with asthma, than as a part of the disease itself. The fact, too, that there is a copious mucous secretion, of itself only indicates an excretory office, the mucous follicles being irritated by the blood, which is in an abnormal condition.

Just how the action on the nervous system is produced, we do not yet sufficiently understand. Dr. Watson, with propriety, regards it as a "spasmodic disorder of the excito-motory system of nerves ;" and he thinks, that "the spasm may be of *centric* or of *eccentric* origin." That is, he thinks the impression may originate in the nervous centres, they responding, somehow but mysteriously, to certain feelings of the mind, and conveying their influence to the part affected, through efferent nerves; or the impression may originate without, be conveyed, by afferent nerves, to

nervous centres, and thence be reflected, as in the other case. When the spasm is of this latter character, or of eccentric origin, the proximate cause or immediate influence, I believe, is often, if not always, congestion of the pulmonary blood-vessels; the blood in these vessels being in an abnormal condition and exciting an abnormal nervous action.

As to the remote causes, if we divide them into predisposing and exciting, we may rank, among the former, a hereditary influence; as the disease often descends from parents to children, and is common to various branches of the family. Neglect, too, in any of the habits tending to promote health, though not sufficient of itself to develop the disease, yet may predispose to do it.

The exciting causes are extremely various; but, the most of them—perhaps not all—are such as directly affect the nerves of respiration or the mucous membrane of the air-passages,—as, for instance, the inhalation of certain perfumes or deleterious gases, the respiration of air in a close room, and possibly those changes of the atmosphere which are shown by the thermometer, the barometer, and the hygrometer, and, indeed, almost any atmospherical change. Sometimes, a change from a country to a sea air, or *vice versa*; or from a higher and more airy part of the same town to a lower and more confined, or *vice versa*, will induce an asthmatic attack. With most persons of an asthmatic tendency, the dust of hay produces a ready effect; and, in some parts of England more especially than in this country, many asthmatics cannot pass a field in which hay is being made in the summer, without great suffering. By this influence a paroxysm will often be immediately developed in those who were entirely free from any apparent influence of the disease, before they approached the exciting cause. In some persons, too, the dust of the powder of ipecacuanha will instantly and severely excite the affection. The suppression, however, of some normal drain to the system, as the catamenia in the female, or of a long-continued abnormal drain with either sex, as the discharge of an ulcer, by disordering the circulation and congesting the blood-vessels of the bronchi, will develop the disease. So, too, sometimes, will the arrest of a rheumatic or a neuralgic affection,—by a direct diversion of nervous influence. But the most common of all causes, probably, is ex-

posure to cold, usually called *taking cold.* By this we are not necessarily to understand the development of any appreciable bronchitis; but the checking of the perspiration and the congestion of the bronchial blood-vessels, while the system is predisposed to asthma, will excite the nervous derangement.

The conditions, which, in the same individual, give rise to the disease, usually remain nearly the same; but, in different individuals, very unlike, and even the most opposite conditions will become the exciting cause. The idiosyncrasies in this disease are among the most striking to which the human system is subject; and, in the present state of physiological science, are altogether inexplicable. The opinion has quite extensively prevailed, that asthma is, in its nature, incompatible with phthisis. It is, however, quite certain that the former disease gives place to the latter; so that a person who has been asthmatic for years, at length dies of tubercular consumption.

Diagnosis. — The symptoms indicating asthma are various. Some of them are premonitory, and, by those who are accustomed to the affection, are understood as warnings of an approaching attack. Among these are loss of appetite, flatulence, eructation, languor, irritability, drowsiness, oppression, and chilliness. Perhaps, he retires at night with a sense of uncomfortableness.

It is very common for an attack actually to commence sometime after midnight, or about 2 or 3 o'clock in the morning, and the general signs are much like the following:—Often the person is aroused from sleep, by a feeling of constriction across his chest, or inability properly to expand it. He raises himself in bed, and sits bowing forward, perhaps with his elbows resting on his knees drawn up before him. His breathing is labored, and attended with a wheezing noise, often so loud as to be audible in another apartment or at a distance. He asks for more air to be admitted into the room, and he makes a strong voluntary effort to expand his chest in inspiration and to contract it in expiration; or, if able, he rises from his bed, and hastens to a door or a window, which he opens, and at which, however cold the weather, he often long remains. The labor of respiration gives warmth to his body, and he often perspires freely. His extremities, however, are liable to

become cold, and his countenance is generally distressed, pale, and haggard, though sometimes it is rather flushed and turgid. Often the pulse is small, feeble, and irregular, though sometimes it is scarcely disturbed. Sometimes the heart palpitates, and flatulency becomes troublesome; the urine becomes copious and pale, and even the fæces are passed with the impatient hurry of spasmodic action. The speech of the sufferer is interrupted and difficult; and there is a propensity to cough which he sometimes favors, with the hope of forcing away the impediment to his breathing.

The disease, however, appears in different instances, with very different degrees of severity. Sometimes its influence is so slight, that the patient, by having his head pretty highly elevated, can sleep in bed without great inconvenience. The disturbing effect may even be less than this. He sleeps in the ordinary position, but is occasionally awakened; or, if not awakened, he has unwelcome dreams, in consequence of oppression at the chest and inconvenience in respiration.

The physical signs are mostly of a negative character. The sibilant rale, however, is commonly well developed, both in inspiration and in expiration; and it has the peculiarity of being a more protracted sound than is heard in any other disease. Frequently, instead of this rale, or in combination with it, we hear what may be called a wheezing sound, and may be described as a course and rough whistling, or a sound somewhat related to the sonorous rale. It is made in the larger and the medium-sized tubes, by means of their continuation and the modification of their form and size arising from the presence of thick stringy mucus. Asthma may be complicated with bronchitis, and then we may have some of the other rales, and some of the diseased sounds of respiration; but the sibilant rale, and a modification of it, in a prolonged sound, are all that strictly characterize asthma itself, except at the period when a paroxysm is leaving. When a copious quantity of mucus is detached and about to be expectorated, its presence in the larger bronchi creates the mucous rale.

A paroxysm of asthma, usually commencing, as I have said, in the night, very commonly passes entirely away with the

approach of morning light, or early in the forenoon. It, however, is very liable to return, each succeeding night, and annoy the sufferer nightly, for a considerable time; after which it may disappear for several weeks or even months. With some persons who are subject to severe attacks, it will, on being by any cause induced, last for several days, and, at length, will either gradually decline, or be suddenly relieved by a free discharge of glairy mucus, very commonly in connection with vomiting, and a copious perspiration, and sometimes being attended with abnormal urinary and fæcal secretions. In some cases, the discharge of mucus is much greater than in others. When it is somewhat copious, the asthma is frequently characterized as humid, but, when the discharge is scanty, the disease is called dry asthma. This distinction, however, is not important. I will only add to this description of the manner in which the disease manifests itself, that, while in its mildest forms it is but little regarded, it sometimes is so severe as to alarm both the patient and the attendants. Indeed, suffocation seems almost unavoidable. One person whom I have several times treated, in the severity of a paroxysm, has found respiration, for hours and even for two or more days, when unable to procure the proper treatment, so exceedingly difficult, that it seemed to him, to use his own language, "as though every breath must be the last." His nervous system, too, would be so generally involved, that he could scarcely endure the slightest whisper in the room, or the lightest tread on the floor.

There are other diseases which create a dyspnœa *somewhat* resembling that of asthma. Among these are emphysema, bronchitis, tubercles, and such tumors as press upon the trachea or the larger bronchial tubes; also, certain diseases of the heart, an aneurism of the aorta, and the nervous affection, called *angina pectoris*. Each of these diseases, however, has its peculiarities; and no one of them has all the symptoms characterizing asthma. The paroxysmal character, the wheezing, and the prolongation of the sibilant rale, especially, all differ, in a marked degree, from what is witnessed in any other disease.

Asthma is common to both sexes, but is experienced by men more frequently than by women. It is regarded as belonging more to the middle portion of a person's life than to the extremes

of youth and old age. In the latter extreme, I presume, it seldom *begins*. As far, however, as my own observation has gone, those who have been subject to attacks of it in middle age have pretty generally retained the liability, as they have advanced in life. It occasionally, too, shows itself in youth and even in the young. I once knew it to appear, in its marked form, in a female child aged but four years.

The *prognosis* in asthma, is, in a sense, almost always favorable; that is, the disease, not only does not prove fatal in itself, but its paroxysms are generally removed in a short time. It is far more annoying than it is really dangerous.

Treatment.—In delineating the treatment suited to the relief of asthma, I would premise, that occasionally the disease is arrested. After afflicting a person paroxysmally for years, it makes its final exit unbidden. In such a case, there is, of course, a cause, although it is unassignable.

But when means, designed or undesigned, are used, sometimes those apparently the most trifling in their nature will prove effective; at least, for a season, as, for instance, an apparently insignificant impression made directly on some portion of the nervous system, or even only indirectly through the influence of the imagination. Sometimes a slight change of residence or of atmospheric influence, will issue in speedy relief to the sufferer.

Hygienic means may also accomplish something in the way of removing or of warding off the disease. Hence, the adoption of a more wholesome kind of food, the use of demulcent and alkaline drinks, bathing under proper circumstances, and other attentions to the surface, will serve as a protection to the system.

Among the more strictly medicinal agents employed to relieve paroxysms of asthma, we may reckon opium, hyoscyamus, stramonium, digitalis, and other narcotics. These, however, taken by the stomach, seldom have much efficacy. Stramonium, tobacco, green tea, and other narcotics and anti-spasmodics have been *smoked* sometimes with decided advantage; that is, the smoke from these articles burning, being drawn into and diffused through the bronchial tubes, sometimes, by its local effect, relaxes the spasm. So, too, in some instances, will the vapor of camphor

inhaled, by the patient's breathing through a quill which contains a small quantity of the gum. The camphor slowly volatilizes, and thereby comes in direct contact with the lungs. The inhalation of the smoke of dried paper, after having been saturated with nitrate of potassa water in many cases will give relief.

Sometimes the nauseants combined with diaphoretics, have some favorable effect, as the sirup of squills in connection with senega. Even ipecacuanha, the dust of which will induce an attack with some persons, has occasionally afforded partial relief.

Sometimes stimulants, as sulphuric ether, or alcoholic stimulants, especially brandy, and various vegetable stimulants, by giving a more vigorous and healthy action to the nerves, afford some temporary relief. For a like reason, irritants, applied between the shoulders posteriorly, so as to stimulate the spine, often have a favorable effect. Warm water applied to the feet, the spine or the chest will sometimes relieve, by removing congestion, and relaxing the nervous system.

But of all remedies now known none is so efficacious in affording speedy relief, as a preparation of lobelia inflata. It is an anti-spasmodic and a nervine. In other words, it subdues the spasm and strengthens the nerves. I prefer, however, to combine it, in equal proportion, with another simple nervine; and I use either the cypripedium pubescens, or the scutellaria lateriflora. Take of either of the latter nervines one part and of lobelia one part, and make a wine tincture with Sicily Madeira, or other pure wine. The dose is one fluid dram, which may be repeated in severe cases, at intervals of fifteen or thirty minutes, till it produces vomiting. In milder cases, the same dose may be given, once in from two to four hours. It then quiets the spasm without emesis. If, in union with this, the patient takes also spirits of turpentine, in doses of from fifteen to thirty drops once in four hours, perhaps the remedy will relieve a spasm as quickly and as completely as any agent now known. Lobelia may also be applied over the chest anteriorly, or over the spine behind the chest with a good effect. So, too, may the spirits of turpentine, used alone, or united with lobelia tincture, acetic acid, essential oil of lemons, or suspended in the yolk of an egg.

But among all the agents worthy of a local application, none,

I believe, is more effective than electricity or galvanism. The best method of applying this, ordinarily, is by the use of plates of copper and zinc, so united and adjusted that the perspiration of the body shall sustain the galvanic action of the plates. A common battery, however, may be employed, the positive and the negative buttons being placed, one over the last cervical or the first dorsal vertebra posteriorly, and the other anteriorly over the sternum and near the ensiform cartilage.

The means thus far named are principally employed to palliate or relieve a paroxysm; though some of them may, with propriety, be employed to keep in subjection the tendency to attacks. Other remedies have been recommended, to be regularly or occasionally employed to subdue the asthmatic propensity. Among these none has a greater reputation, or has been more effective, probably, than the seed of the sinapis alba, called the white or English mustard. This should be taken unground, in doses of a full teaspoonful or more in connection with each meal.

In the severe case to which I have already referred, the paroxysm would always be greatly palliated by the use of the tincture of lobelia and cypripedium. Still, they would return; and the propensity to the attacks seemed scarcely lessened by any agent employed, till the patient resorted to the use of the white mustard, in doses as above directed. Since commencing the use of this remedy, now more than a year, he has been almost entirely exempt from asthmatic attacks.

CHAPTER IV.

MORBID CHANGES IN THE BRONCHI.

Pathology.—There are two classes of lesions to which the bronchi are subject, and which uniformly result from pertussis or some form of bronchitis. They are dilatation and contraction. Though they are so different from each other, and, in some respects, opposed, yet they have also points of intimate relation, and I choose, therefore, to consider them in connection. The former is, by far, the more frequent lesion, and is worthy of more careful consideration. It is produced by the violence of

coughing, and perhaps, in part, by the pressure of a large quantity of mucus within the tubes. At any rate, it is found to exist in connection with a copious secretion, which is not readily expectorated.

Dilatation of the bronchi has several modifications of form. Sometimes a single bronchus, or several ramifications of bronchi, become rather uniformly enlarged throughout; or the branches may even be larger than the principal trunk affected. In this case, a tube, which, while of a normal size, would only admit a common probe, will sometimes become large enough to receive a goose-quill, or even a person's finger. Accompanying this dilatation, it is proper to remark, the mucous membrane of the enlarged tubes becomes thickened by the existing inflammation or its effects, and loses its transparency. In another variety of dilatation, the enlargement exists in a single spot, so as to form a cavity at that spot. This cavity is sometimes of the size of a chestnut. In this case, as in the first, the mucous membrane is generally thickened. A third variety consists in there being a series of such cavities. In this case, the coats are sometimes thin, the dilatation being the result of weakness and pressure, not accompanied with or preceded by much active inflammation. As the consequence, the disease is attended with more debility than the other varieties; and almost any increase of respiration produces dyspnœa.

Generally, in the different cases, there is, to a greater or less extent, a condensation of pulmonary tissue around the dilated bronchi. This is caused by a deposit of new matter, essentially in the same way as all granulation structures are formed. It is usually regarded, however, as more albuminous or less highly organized, than are ordinary deposits on serous membranes. It is more like the secretion from the mucous membrane of the trachea in croup.

The other class of lesions to which the bronchi are subject, and to which I have referred, consists of cases in which the walls of the tubes become thickened and the caliber diminished. In these cases, if there is a secretion, it is essentially the same as that of croup. It is the result of active preceding inflammation, not attended by the violence which produces enlargement. The

albuminous deposit may completely obliterate the canal of a tube; and when it does, it is sometimes called *a bronchial polypus.* The tubal cavity, however, may be blocked up, by simple inflammation, which, for the time being, thickens the walls. In the former case, the obstruction is permanent, unless removed by ulceration or absorption, as is the deposit in pneumonitis. In the latter case, the difficulty vanishes with the subsidence of the inflammation.

Diagnosis.—In that variety of dilatation in which the enlargement extends equally throughout a tube or tubes, the air does not so reverberate as to give cavernous respiration. Of course, the sound is only the shrill bronchial; and the character is rendered full and marked, in proportion to the degree of inflammation and induration in and around the tubes. When the enlarged tubes are loaded with mucus, we have, of course, the mucous rale; or, in case some of the smaller tubes are enlarged to those of medium size only, we then have in them the sub-crepitant rale. The respiration being the shrill bronchial, the sound of the voice, heard over the enlarged tubes, will be that of bronchophony.

In the second variety, and in the third, we have distinct cavernous respiration and pectoriloquy; inasmuch as a cavity and cavities, in these cases, are distinctly formed. Or when these cavities are loaded with mucus, we necessarily have the gurgling rale.

In all cases, in which there is appreciable induration of the pulmonary tissue around the dilated tubes, we, of course, have dullness on percussion, much the same as in pneumonitis.

The discrimination of this lesion from pneumonitis is generally easy. In pneumonitis, the progress of the disease soon changes the character of the sounds heard. In dilatation of the tubes, they remain longer unchanged. In phthisis, sometimes the symptoms of the disease are more nearly like those of dilatation. In phthisis, generally the cough, the fever, the emaciation, and other symptoms will sufficiently characterize the disease; whereas, in dilatation of the tubes simulating tuberculous cavities, there are generally marked evidences of the existence merely of bronchitis. Chronic bronchitis, however, dilatation of tubes, and

tubercles in the lungs may all exist simultaneously, and so render the diagnosis obscure. When the dilated tubes are in the superior lobe of a lung, the tissue of that lung may break down and form a tuberculous cavity, thus bringing the two kinds of cavities into juxtaposition, or uniting both in one.

In the second class of lesions, the prominent auscultatory sign is a diminution or almost a cessation of the respiratory sound, over the affected part, the effect, of course, being proportioned to the degree of obstruction in the tubes. The bronchial cavity may be even entirely obliterated in some parts, and then the respiration in those parts will be entirely wanting. When the obstruction is from inflammation and not from a deposit of albuminous matter, the absence of the respiratory sound is of short duration. If a collection of mucus assists the inflammation in producing the obstruction, the simple act of coughing may partially restore the sound of respiration. When there actually is an adventitious deposit, the absence of the respiratory sound will, of course, continue permanently, or till that deposit is removed by ulceration or absorption.

The *prognosis* generally, in cases of morbid changes in the bronchi, is often favorable. Often a partial or an entire cure may be wrought, and, where it cannot, but the lesion continues unabated, still, if not complicated with a more serious affection, it seldom hastens very greatly the termination of life. It weakens the vital powers, but does not immediately arrest their action.

Treatment.—The treatment to be adopted in the cure of morbid changes in the bronchi is not extensive nor difficult. But little comparatively can be accomplished, directly, by any remedial means. The object to be mainly aimed at, is to remove any existing bronchitis or other attending affection, and to strengthen the powers of vitality, that, as far as possible, they may restore the parts to their normal condition.

CHAPTER V.

PNEUMONITIS.

The term pneumonitis is formed from the Greek word, πνευμων, signifying a lung, by appending *itis*, the usual termination to indicate inflammation. *Pneumonia*, it is true, is the orthography more commonly adopted; but, as this is not analogical, I reject it.

Like bronchitis, pneumonitis is ordinarily an acute and primary disease, but has, at the same time, several modifications of form, which require special consideration. Its mode of existence differs from that of bronchitis in one important respect:—it never assumes a form so distinctly chronic as that which is sometimes taken by bronchitis. In illustrating the disease, I prefer, for brevity's sake, to describe its usual characteristics under the unqualified designation of *pneumonitis*.

Section I.

PNEUMONITIS.

Pathology.—This disease is generally said to consist in inflammation of the *areolar tissue* of the lungs. But shall we use the terms parenchyma and areolar tissue as synonymous, and say that the inflammation is limited to that tissue? To answer this question understandingly, we must first attend to a few considerations in the anatomical structure of the lungs.

The ultimate ramifications of the bronchi terminate in vesicles, which are arranged in lobules,—the vesicles of each lobule communicating with one another, but not with those of other lobules. Each lobule is supplied with capillary blood-vessels, which surround and line the vesicles with a minute and intricate plexus, so arranged as to form the parietes of contiguous cells, and thereby favor the aeration of the contained blood, by exposing it, on both sides, to the contact of the contained air. These bronchi, vesicles, and blood-vessels, together with lymphatics and nerves which accompany them, are bound together by strong

areolar tissue ; and every portion whose vesicles are involuted as described, constitutes a lobule. Since, now the term parenchyma is used to express the substance of the lungs, it may, with propriety, be extended so as to embrace not merely the areolar tissue, but all these tissues united, so far as they are contained in and constitute lobules,—particularly the areolar tissue, the blood-vessels, the vesicles, and the extremities of the bronchi terminating in the vesicles.

The older pathologists have discussed the question, whether pneumonitis is really inflammation of the areolar tissue or only of the vesicles; but, in view of the anatomy of the parts as just described, and in the light which is now thrown on the nature of inflammation, it cannot for a moment be doubted that, in this disease, all the tissues in the lobules are involuted. Indeed, *post mortem* examinations have set the matter at rest ;—*it is so.* Bronchitis is inflammation of the mucous or lining membrane of the tubes, whether that inflammation extends to the extremities of the tubes or not. Pneumonitis is inflammation extending throughout the substance of the lung embracing every thing but the pleura, which is the external lining.

Pneumonitis may commence in either of two ways. It may have its origin in bronchitis,—the inflammation on the mucous tissue of the bronchi, passing down to the vesicles and thence involving the other tissues; or it may commence directly in the tissues constituting the vesicular structure, and extend to the surface of the lung, there implicating the pleura, and constituting pleuro-pneumonitis. The pleura may even be the part primarily inflamed ; and, from this, the inflammation may extend inward upon the parenchyma. When, in such a case, the evidences of inflammation of the pleura are more marked than those of inflam mation of the parenchyma of the lungs, the term *pneumo-pleuritis* has sometimes been employed to designate the disease, it being then intended to restrict the *pleuro-pneumonitis* or *pleuro-pneumonia* to those cases in which the pulmonary parenchyma is most affected.

Unlike bronchitis, pneumonitis is, almost always, attended with considerable constitutional disturbance. The reason of the dif ference is obvious. In bronchitis, the bronchial tubes are open,

the respiration is free, and the secretion into the tubes is expectorated without difficulty. In pneumonitis, on the contrary, the inflammation of the lobules not only prevents the admission of air into them, but closes the bronchial exit from them, and confines the secretion, creating new degrees of disturbance. The failure of the blood to be properly arterialized, therefore, and of the secretion to be properly passed off, is a double cause of febrile action in the system. It is true, that in the latter disease, there is, at length, a copious expectoration; but this is not until the secretion has been for a time confined, and a good deal of constitutional disturbance has been created. The failure in the arterialization of the blood, however, is doubtless the principal cause of the febrile excitement.

Pneumonitis is divided into four stages, characterized by marked pathological changes. The first of these I call the stage of infiltration. It has been called the stage of engorgement, of congestion, and of inflammation. The pathological condition of the lung is that of inflammation, combined with effusion or anasarca. If a portion of the tissue be examined, it will be found that, besides a little mucus in the smallest tubes, the capillaries are loaded with blood, as in other cases of inflammation, and the tissues are slightly softened. But, besides this condition, there is also an effusion of a reddish and turbid serum. Evidently, the obstruction to the circulation produced in the capillaries, by what is inflammation properly so called, gives origin to a congestion of the venous blood in the ramifications of the pulmonary artery; and, from this congestion, arises the effusion. Under these circumstances the lung is, of course, of a reddish-brown color, being somewhat swollen, pitting on pressure, crepitating less, though more friable, and, if incised, yielding the serum referred to.

The state of the lung in the infiltration of pneumonitis is nearly indentical with that which is very commonly found in the postero-inferior portion of each lung after death,—especially with those persons who have died, after lung agony. In the latter case, there is, indeed, but little more than the effects of a *stasis* of the blood, arising from position and from weakness; but, then, in this active state of inflammation, there is yet not so great chem-

ical or vital change wrought in the blood as to make any appreciable difference.

The pathology of this stage of pneumonitis, being so simple and easily understood, ought not to be overlooked; and yet many practitioners and some professed pathologists have failed to have any definite perception of the real condition of things.

The second stage of pneumonitis I call that of hepatization. It has also been called red hepatization, red softening, and hardening. The reasons of these different names are found in the characteristic condition of the lung in this stage. I need not stop to explain them, farther than to say, that hepatization is a term derived from ηπαρ, signifying liver. Hepatization, therefore, means the being made like, or the resemblance to liver; and this resemblance is the most striking feature in the appearance of the lung in this stage.

The pathology of the affected part is really the thing important to be understood. In treating of inflammation and the reparative process, I have shown the pathology of each, and the connection of one with the other. I have, also, in another place remarked, that there is sometimes a process of exudation, from mucous tissues, following their inflammation, and resembling the reparative process, but forming a structure that is but imperfectly organized. Consider, now, that the first stage of pneumonitis is substantially one of inflammation; and that, succeeding that must be substantially the condition produced by the establishment of the reparative process. So far, however, as the exudation process takes place within the smallest bronchial tubes and the vesicles, it is possible, that the deposit may not be of the most plastic or organized kind. Be that as it may, the process, as it ordinarily succeeds inflammation, is always the granulating or partially chemical process;—it is that process, the deposit of which is removed, as the perfect structure is afterwards more slowly formed. To suppose, then, that a hepatized lung returns to its normal condition is to suppose merely, that the granulation structure is removed, by interstitial absorption or otherwise, and that the ordinary form of the reparative process is again established.

Having thus asserted what hepatization is, let us see how the pathological appearances will sustain the assertion. In passing

from the first to the second stage, the lung generally assumes a somewhat brighter hue, like that of liver and nearly like that of granulations generally. It appears swollen and heavy. Indeed, while in the first stage, as well as in health, pulmonary tissue is lighter than water, but any portion, in the second stage, separated from the rest, will sink in water. It does not crepitate; and, when pressed by the fingers, feels solid like liver. When the substance is incised, a smooth surface is exhibited; usually, however, having some red shades darker than others. In being torn, its tissues are found to be somewhat softened, that is, its particles are less adherent than in health, and, when pressed, a slightly viscid and reddish fluid will exude in a moderate quantity. The incised surface, being carefully examined, generally shows itself studded with small, red, and rounded granulations, which are the abnormal contents of the vesicles. In some cases, however, the granulations seem to be packed so closely as to coalesce and not show their distinctive character.

In all this, there is, I believe, nothing inconsistent with my position, but much, at least, to confirm it. To my own mind, at any rate, these and other evidences combined are conclusive. Let then the pathology of this stage be distinctly understood.

The third stage of pneumonitis I call that of suppuration. It has, also, received the names of gray softening, gray hepatization, purulent infiltration, and yellow hepatization; the reasons for the use of which it is easy to find in the pathological condition of the part affected. In this stage, the lung still is, to a considerable extent solid, though it is infiltrated with purulent matter, diffused through the areolar tissue and deposited in the vesicles; so that, when any part is incised and subjected to pressure, this matter exudes abundantly. The lung is as impervious to air, as in the second stage, and it as readily sinks in water. On being subjected to force, the particles are found to be less adherent than in the second stage. Its surface, especially its cut surface, is of a marbled appearance,—at the early part of this stage, being rather red and gray, but, at a later period, gray and yellow. The granular appearance is not as distinct as in the second stage, and what granulations remain have a yellowish color. At length, the tissue generally assumes a straw color, and is so friable, as, on the

slightest pressure of the finger, to break down into a purulent detritus. By placing a portion of lung, in this stage, under a stream of water, all the parts but the bronchial tubes wash away, and leave those tubes free. When this is done, it is seen, that the tubes have contained purulent liquid, and that the bronchial mucous membrane is not so red as it is in the second stage.

The fourth stage of pneumonitis I call that of ulceration. This stage and the third have very commonly, by pathologists, been combined together, as one stage. Pathology, however, affords sufficient reason for the division. In this stage, an abscess or abscesses are formed, in the parenchyma of the affected lung, resembling an ordinary abscess in other tissues of the body; in other words, a portion of the lung softens down and ulcerates away, and the detritus is removed by expectoration. Of course, a cavity or cavities remain; and this constitutes the prominent characteristic of this stage of the disease.

Pneumonitis may be either single or double; that is, it may affect either one side only, or both sides. If both sides become simultaneously and extensively affected, the disease is almost necessarily fatal. Fortunately this condition but seldom occurs. It is generally considered, that pneumonitis occurs much more frequently on the right side than on the left. In my own practice, I have never kept any statistics, but my impression is, that the disparity in the number of cases on each side has not been great. Again, authors tell us, that this disease, very commonly but far from uniformly, commences at the lower portion of the lung. Andral's statistical representation is, that, of eighty-eight cases of pneumonia, he found the inflammation affected the inferior lobe forty-seven times, the superior lobe thirty, and the whole lung at once eleven. I know not what has occurred with other practitioners and in other countries; but, in my own practice in this country, I have never found a solitary case in which idiopathic or active primary pneumonitis did not begin in the lower half of the lung. If on the right side, it may, perhaps, affect the lower portion of the middle lobe, simultaneously with the inferior lobe; but I do not believe that, in this country, it ever commences in the superior lobe, or seizes on that to the neglect of the inferior. If the case be a severe one, it sometimes advances upward till it in-

volves the whole lung; but, in most instances, it is limited to the lower half.

Diagnosis.—As to some of the constitutional and rational symptoms, I remark that quite frequently pneumonitis commences with a chill and shivering, which lasts for an hour or more, and is followed by an abnormal amount of heat and an increased fullness and frequency of pulse; in other words, by inflammatory fever. Indeed, in this case, the pulse generally ranges from ninety to one hundred and twenty per minute, and is of considerable strength; though, in an advanced period of the disease, it may be even more rapid and may be comparatively feeble. Sometimes, however, the disease comes on more gradually and insidiously, being introduced by the earlier existence of bronchitis; that is, inflammation commences on the mucous membrane of some of the bronchial ramifications, and passes to the smallest tubes, the vesicles and the interstitial textures. Of course, the febrile symptoms are less rapidly developed, though they are essentially the same.

In the former case, the disease is generally attended by a peculiar lancinating pain usually termed a *stitch* in the side;—in the latter, this pain may or may not be experienced. When it exists, it is of that peculiar character which marks inflammation of a serous tissue; and it is generally believed to arise from inflammation of the pleura. In other words, it is supposed, that the cases of pneumonitis which are attended by it, are all really cases of pleuro-pneumonitis,—the pleura, as well as the pulmonary parenchyma, being involved. It is supposed that inflammation of the parenchyma alone, gives no pain. Inasmuch, however, as blood-vessels contain serous tissue, and pervade the lungs, I do not consider it, by any means, certain, that *all pain* in this disease, is limited to cases of pleuro-pneumonitis; though, doubtless, all very severe and lancinating pain is so limited. The location of the pain is generally on a level with, or a little below the nipple on the affected side. It is aggravated by the act of coughing, by a full inspiration, by certain changes of posture, especially if they are suddenly made, by percussion, and by ordinary pressure, either on the ribs or on the intercostal spaces. It is the most severe, at

the early part of the disease, and it gradually declines. It ceases entirely, sometime before the disease passes away.

The cough of pneumonitis is at least generally short and suppressed. The patient being unable fully to inflate his lungs, air is not expired in sufficient amount to produce loudness of sound. Besides, the pain caused by coughing induces him voluntarily to repress the act as far as he conveniently can. As the disease passes into the second stage, the cough becomes loose and the expectoration somewhat abundant. The character of the sputa changes with the different stages; but the looseness of the cough and the pureness of the expectoration continue, till the disease has very far receded.

The sputa at first do not differ much from those of ordinary bronchitis; but, as the disease passes into the second stage, they become viscid and rusty, and constitute the most distinctly pathognomonic sign of this stage. They are made up of thick adhesive mucus secreted into the bronchial tubes, and of blood discharged from the hepatized lung. The viscidity is so great, that the cup, even when containing a considerable quantity of the sputa, may be nearly or quite inverted, without parting with its contents. The mucus and the blood are not rarely so mixed, that the one shall be streaked with the other; but they are fully incorporated, the one with the other, so as to present a uniform color throughout, and that is very nearly the color of iron rust. This peculiarity is found in no other dissase whatever, and in none but the second stage of this disease. Of course, it unerringly marks this disease and this stage of it. In this stage, a decided increase in the quantity of the sputa is evidence, that the disease has begun to retrograde.

In the third stage, the sputa are more purulent, and generally more abundant than in the second. When the disease recedes from this stage, the sputa become thinner and less purulent.

As a cavity forms constituting the fourth stage, a large quantity of decided purulent sputa are discharged in a short time; but, if recovery is effected, the discharge afterwards or much the same, as in recovery from the third stage.

The frequency of respiration in this disease is proportioned somewhat to the extent of the inflammation. Difference of tem-

perament, it is true, will make considerable difference in the case, —a *nervous* person being liable to considerable excitement from the irritability of the nervous system. But, aside from incidental causes, the smaller the quantity of air which enters the lungs at one inspiration to arterialize the blood, the sooner it is necessary that the inspiration be repeated; and the vital powers are so balanced, that, when the former does not operate to produce a large inspiration, it does operate to produce more than one short one. If there is but slight disease on one lung only, the respiration is not greatly quickened. If the whole of the inferior lobe is involved, the inspirations will be from forty to fifty per minute; and, when the greater portion of the lung is involved, the respirations are liable to be from fifty to sixty per minute. If both lungs are involved, or the difficulty has become of a serious character, the respirations may be even more frequent.

The mode of respiration in pneumonitis is somewhat peculiar. Usually, it is performed chiefly by the side of the thorax which is not diseased. When, however, a severe case has continued for a considerable time, the ribs cease, to a great extent, to be moved, and the respiration becomes mainly abdominal.

The flush of the countenance in pneumonitis, also, indicates the disease. It is sometimes a circumscribed and circular flush on one cheek,—generally that on the side of the affected lung,—and sometimes a similar flush on both cheeks at the same time. Sometimes, too, the whole face is flushed; and the color varies, from that of arterial to that of venous blood. This variety depends essentially on the amount of obstruction which the blood receives in passing through the lungs.

Dilatation of the nostrils in each inspiration is an indication of this disease, depending upon the existing dyspnœa and proportioned to its extent.

The peculiar failure of the physical strength is another sign of pneumonitis worthy of some regard. The patient will often find himself too much enfeebled to sit up, at the commencement of this disease, even when it is not very severe, and before the physical or other signs have fully disclosed its nature.

The *physical* signs of pneumonitis vary, in a marked degree, with the successive stages. In the *first* stage, the most important

sign is the crepitant rale. This, indeed, when heard, is pathognomonic of the disease in this stage; but it never continues but a short time, and commonly passes away before the patient considers himself sick enough to call a physician. Besides, if the inflammation is only deep-seated and does not involve the surface of the lung, either the crepitus does not exist, or the healthy respiration from the surface prevents its being heard. Probably the vesicles and smallest tubes are so compressed that air cannot pass through them to produce the rustling. In this stage, the bronchial respiration of health is but slightly altered. It sometimes partakes appreciably of the shrill bronchial character, in consequence of the interruption of the vesicular sound, and the slight hardening given to the lung by its infiltration. The latter condition is also indicated by a slight modification of bronchophony from the condition of health. Percussion yields nearly the resonance of health. The infiltration and the displacement of the air from the tubes may render the sound slightly dull, but never considerably so.

In the *second* stage, the physical signs are marked and unerring. There is no longer any crepitant rale, for the smallest tubes are completely blocked up, or, for the time being, obliterated; but the hepatization of the lung gives the shrill bronchial respiration in its most intense degree. The vesicular sound is not made, and therefore does not modify the bronchial; but the consolidation of the lung conveys the most perfectly to the ear the sound made in the medium-sized and largest tubes. As primary or idiopathic pneumonitis affects primarily and mainly the lower portion of the lung, we have the shrill bronchial respiration the most marked at the root of the lungs. The longest tubes, of course, make the fullest sound; and, if the pulmonary tissue around them is completely hardened, the sound approaches in character to tracheal or cavernous respiration. The term *tubal* has sometimes been employed to express the intensity of this sound. Of course, that is using the term in a sense different from that in which I employ it. Sometimes, especially if the patient breathes rapidly, the crepitant rale may be heard coexisting with the bronchial respiration; but that is because, as the inflammation extends, a portion of the lung having begun more recently to be affected, is only in the first stage of the disease, while the more

prominent portion has reached the second. In such a case, the crepitation, extending a little further from the vesicles into the tubes than is commonly done, is not of the most delicate character, and is heard somewhat in trains like the sound of wet gun powder, in those portions of the lungs which are infiltrated but not solidified. In the second stage of the disease, the induration of the lung also gives the most perfect and extended bronchophony. No other disease can well imitate the shrill bronchial respiration and the bronchophony of pneumonitis. On percussion in this stage, we usually find the greatest dullness which can result from any cause, except the presence of a liquid, and it is nearly or quite equal to that. I once knew, however, one case of pneumonitis of the left lung, which resulted fatally, and which, for several days before death, gave the resonance of pneumothorax. The autopsy revealed a large empty space between the parietes of the thorax on the left side and the lung, though the latter was extensively hepatized. The lung was firmly held or crowded back against the spine and posterior part of the ribs. There was, however, evidence that pneumothorax complicated the disease, during the last few days of the patient's life.

When the symptoms now described indicate the several stages of pneumonitis, if the patient coughs,—and we may direct him to do it,—the shrill bronchial sound will become more marked, and the air will be driven so forcibly into such of the swollen tubes as are not entirely closed as to produce a peculiar modification of the crepitant rale.

In the *third* stage, the shrill bronchial respiration and the bronchophony of the second stage have nearly or quite passed away. When suppuration has only begun, the lung, it is true, has not, to a great extent, softened; but there is a free muco-purulent discharge into the bronchi. This so interrupts the passage of air as to give origin to the mucous and the sub-crepitant rales in the largest and the medium-sized tubes, while, by lubricating, as well as by obstructing the bronchi, it prevents the characteristic bronchial sound of the respiration and of the voice. Percussion in this stage remains flat; that is, essentially as dull as in the second stage. For, though the lung has actually *begun* to soften, and some of the smaller bronchial orifices before

closed are opening, yet their orifices are filled with purulent matter, and will give to percussion as perfect dullness as the more complete hepatization would give. It is proper here to remark, that even when a considerable portion of the affected part of the lung is in the third stage of the disease, another portion may be in the second, and some portion still in the first stage; and, hence, we may at some points get the sounds of the second stage, and, by requiring the patient to respire strongly, we may even hear something of the crepitant rale indicative of the existence of the first stage in still other portions.

In the *fourth* stage, when the cavity that is formed is partially filled with muco-purulent matter, we have the gurgling rale. When the matter is expectorated, as sometimes after a hard coughing especially it is, we have cavernous respiration. Percussion over the cavity will be more or less resonant; and, if the cavity be near the surface, we sometimes get the *cracked-pot* sound. Percussion, away from the cavity, but over the diseased portion of the lung, remains flat.

This stage of the disease but seldom occurs; but when it has taken place at one point, other portions of the diseased part will, of course, be in a less advanced condition, and will present symptoms corresponding with the stage in which they are found.

There is, in pneumonitis, when it is not fatal, what may be called *a period of recovery;* but the *signs of return* to health vary according to the stage which it has reached and from which it has to retrace its steps. If it has gone no further than the second stage, its return to the first is indicated by the return of the crepitant rale which, however, is of a looser and more moist character than it was at the first commencement of the disease. As this subsides, it is gradually replaced by the vesicular sound of health, though often a considerable time elapses before the respiration becomes entirely normal. The shrill bronchial character of the respiration and the dullness of percussion do not suddenly cease. The latter, especially, remains, in a degree, till most of the other symptoms have passed away, and the health of the patient is nearly restored. The granulation process involved in the hepatization of the lung has to be removed; and this must be done either by interstitial absorption or by ulceration.

When, however, the return to health is from the third stage, the mucous rale, produced by the mucus and pus in the bronchi, is the first sign of recovery; the former being a secretion from the tubes, and the latter resulting from the ulceration of the tissue involved. The creation and discharge of this muco-purulent matter promote health. As the disease recedes, the liquid becomes less purulent and more mucous, until a normal condition is restored.

If health is restored from the fourth stage, the parts involved in the abscess have to be cicatrized. While this is taking place, there is a free formation, and of course a free discharge of pus; but after the cavity is healed, and the abnormal formation in other parts of the lung is removed, the liquid passing into the tubes becomes entirely mucous, and the normal condition is produced as in the third stage. If, however, the patient sinks under the influence of the disease, at whatever stage the evidences of approaching death appear, the symptoms generally will be aggravated. The dyspnœa will be increased, the pulse will be quickened and rendered feeble, expectoration will become difficult, the countenance will be haggard,—in a word, it will be seen that vitality is yielding its control.

The *prognosis* in a case of pneumonitis, varies according to the circumstances of its severity, the age of the patient, his general previous health, the time at which proper treatment is commenced, &c. When pneumonitis is sthenic in character, the circumstances under which it exists not being unfriendly, the prognosis is favorable. But, when the disease is complicated with other grave affections, when the constitution is worn out with previous disease or with age, when suitable treatment in suitable time, is not adopted, or when the disease for some unknown reason assumes its severest form, the prognosis is unfavorable. Dr. Gerhard says, "A mild case of frank pneumonia, *without treatment*, usually lasts from ten to twenty-one days; but, if it has reached the third stage, it will last much longer." He also says, "If you treat it from the first, you may frequently produce a partial destruction of the disease, and shorten somewhat its duration. When the disorder terminates fatally, death usually occurs early in the third stage, or just in the passage from the second to the third stage.

This stage is reached at different periods,—sometimes in three or four days, but generally about the beginning of the second week." When properly treated from the first,—if I may decide by the results of my own practice,—the disease usually forms a crisis or begins to amend,—if amendment takes place,—in about one week from the time of the attack. After this about the same length of time will be spent in convalescence; though the patient often requires in this time, but little medical attendance. Some cases, of course, are liable to be longer protracted. In the few cases which have proved fatal under my charge, death has occurred at a period of from one to two weeks.

Treatment.—As simple sthenic pneumonitis consists primarily in the local inflammation, and the febrile action is merely *symptomatic*, the nature of the treatment to be adopted is plainly indicated. The removal of the inflammation is the thing to be effected. And, as inflammation commences in capillary congestion and is sustained by it, the blood must be determined away from the lungs,—in other words, the circulation must be equalized. In consequence of the nervous sympathy between the stomach and the circulation, and the tendency of emesis to relax the cutaneous vessels, ordinarily a simple emetic,—for which nothing is better than a proper preparation of lobelia inflata,—is desirable at the outset. After this, for a depurative effect, a due action of the bowels should be sustained, though drastic purgatives should be avoided. As an aperient, no agent better suits most constitutions than leptandria virginica, which may be given in a warm infusion. If this is objectionable on account of the unpleasantness of the dose, the leptandrin may be substituted, its aperient power being increased by the addition of a small quantity of podophyllin;—say take of leptandrin three parts, and of podophyllin one part. If to this, one part of pulverized capsicum be added, its stimulating effect will render the operation milder and more recuperative. Let the quantity be such as barely and easily to evacuate the alimentary canal.

The stomach and bowels having received this attention, expectoration and diaphoresis should be particularly attended to. For this purpose, put the patient under the influence of an expector-

ant and diaphoretic powder. This may be composed of the common fever powder and such expectorant articles, as ictodes fœtida, arum triphyllum, and sanguinaria canadensis. I prefer to have the whole taken, in infusion, every four hours. I also give a pill of lobelia extract, every four hours,—interchanging it with the fever powder, and giving one two hours from the time of taking the other. Or in place of the pill, one fluid dram of the compound sirup of lobelia and sanguinaria may be given. Demulcent drinks, as a mucilage of ulmus fulva, gum acacia, and the like, are of service. Nervines to quiet the nervous system, if necessary, are serviceable; but narcotics are injurious. They suppress the cough, but do it by deadening nervous energy, instead of by removing its cause; and it must be remembered, that, in this instance, the cough is eminently excretory, and not irritative.

For external local applications, if, especially internal heat affects the thorax externally, nothing is more directly serviceable than the application of cold wet cloths over the affected lung,—they being wet anew as often as they become warm. If the symptomatic fever is considerable, a more extensive application of wet cloths to the surface, or even the *pack sheet* will be of service.

Various other agents of a nature similar to those described, may be employed with a similarly beneficial effect. But, whatever be the articles employed, they should fulfil the indications above given, without a depressing effect on the vital powers.

If the patient fails in due time to convalesce, and the disease assumes some new *phasis*, a corresponding modification of treatment will, of course, be required.

[To overcome the fever, I depend on continued and increasing nausea, terminating in emesis. In the beginning of the disease, especially in strong constitutions, the extract pill should be freely given, and a decided impression made upon the circulation of the blood. Many times by a thorough application of this remedy, together with the application of wet cloths to the chest, the disease may be completely arrested. If called in the first stage, I believe that the physician, with these means and other accessory treatment, can in most cases stop its progress. C.]

Section II.

ASTHENIC PNEUMONITIS.

Though pneumonitis, as it is generally experienced, is a sthenic disease, yet it sometimes assumes a decidedly asthenic form. It may take this character from the first, or not till a later period of the disease. In the third stage, especially, the disease, if it has been at all severe, almost necessarily becomes somewhat asthenic, though the asthenia is very differently marked from that which exhibits itself in the commencement of the disease. Pus, being extensively diffused through the lung in the third stage, is necessarily, especially if expectoration is not perfectly free, absorbed in a measure. This produces a hectic effect, and, of course, is extremely protracted. Besides, in the formation of the pus, there is an expenditure of a good deal of vital power.

But the asthenic form which pneumonitis assumes at the ontset of the disease, has an entirely different origin. Its existence supposes some influence to have been previously at work, and to have depressed the vital powers, before the pneumonitis commenced. This influence may belong to one of three classes. It may be the effect of advanced age;—it may be that of generally enfeebled health;—or it may be an epidemic.

In the first case, the pneumonitis is often characterized as *that of old age.* The principal difference between the manifestations of the disease, in this case, and when it is of the ordinary sthenic character, is, its tendency "to become latent, that is, to lose the ordinary functional signs of the acute inflammation, and to offer merely the feebleness and prostration which occur in most severe diseases, with little cough and little or no expectoration." This difference is an important one. If the physician is unacquainted with physical signs, or being acquainted, does not think to explore the chest by means of them, he will fail to recognize the disease. There may be a dusky purple tint of the face, but there is almost nothing in the constitutional and the rational symptoms to point out the true malady. When, however, the pneumonitis of old age is not entirely latent, it yet fails to be as distinctly marked as

it is in its ordinary sthenic form. With few pectoral symptoms, it passes rapidly to the stage of suppuration.

When asthenic pneumonitis arises from the effect of generally enfeebled health, its characteristics are generally the same as are those of the pneumonitis of old age. I have seen this form of the disease in a person of middle age, with whom it came on so clandestinely, that its nature was not, for several days, suspected. The obscurity of the general symptoms finally awakened the thought of exploring the chest by physical signs; and the pathological condition of things was finally discovered, but not till the third stage was fully established.

Asthenic pneumonitis, when arising from either of the above named two classes of influence, may exhibit something of the viscid rusty sputa of ordinary sthenic pneumonitis; or these may be wholly absent. The disease is not usually recognized in season for much specific and appropriate treatment, till the third stage is established. The *prognosis*, in this case, is doubtful.

The *treatment* in this stage differs from that of the same stage, when the disease retains the sthenic form. The expectorants given should be of the stimulating class; and even the simple diffusible stimulants and the ordinary tonics are indicated. The reason for this treatment it will be readily seen, is the necessity for sustaining the enfeebled vital powers. Among the valuable stimulating expectorants, are polygala senega and eupatorium perfoliatum. A union of stimulant and tonic properties is found in myrica cerifera, asarum canadense, and aristolochia serpentaria. An infusion of capsicum and a solution of carbonate of ammonia are also effective as diffusible stimulants, while they do not depress the system afterwards, but leave it more or less sustained. Peruvian bark, also, is a tonic suited to this condition of disease; or, in place of it, quinine or salicine, in proper doses, may be employed.

When asthenic pneumonitis arises from an epidemic influence, or especially from such an influence, combined with the effects of age and generally enfeebled health, the asthenia is somewhat peculiar, and the disease takes the name of typhoid pneumonitis or pneumonia, or, as it is commonly written technically, pneumonia typhoides. This character, may even be assumed in the third

stage of the disease, though it begun as ordinary sthenic pneumonitis. The *positive* effect of injurious drugs and the *negative* influence of neglecting to rebuke disease at an early period, may, in this case as in dysenteria, so deprave the blood and reduce the vital powers, as to get the system into a state similar to that which is produced by miasma or malaria, or whatever creates typhoid fever.

Sometimes pneumonitis has characteristics which have given rise to the term *bilious*. When the disease is on the right lung especially, that the inflammation should extend to the liver which is separated from that lung only by the diaphragm, and that it should affect, to some extent, the secretion of bile, is perfectly natural. If, however, the phrase bilious pneumonitis may ever be employed with propriety to express any complication of this kind, I think it should be limited to those cases in which, through some epidemic influence, the biliary disturbance is considerable, and the disease has, on the whole, a decided typhoid character. It sometimes happens that, not only the skin and the urine are yellow with bile, and the matter ejected by vomiting is bilious, but the sputa, also, are deeply tinged with bile,—they forming a part of the bronchial secretion. In such a case, if in any, we may apply the phrase *bilious pneumonitis*; for the biliary disturbance actually affects the pulmonary secretion. This, however, is only a modification of typhoid pneumonitis.

When pneumonitis assumes the typhoid type, some of the general symptoms are decidedly different from those of the usual form of the disease. For instance, instead of a forcible, we have a feeble, and, instead of active excitement in the capillaries, we have diminished action. We have, also, a rapid prostration of strength; a thickly coated and sometimes a parched tongue; sometimes, too, a delirious or comatose state of the mind; in short, we have, to a greater or less extent, the symptoms of typhus or typhoid fever. In this case, the *prognosis* is very unfavorable.

The *treatment* of pneumonitis typhoides, is, in some respects, unlike that of the other asthenic forms of the disease. It must be stimulating and expectorant; but the ordinary bitter tonics will not, to any extent, be borne. On the contrary, the treatment must be diaphoretic and anti-febrile. Wine, ammonia, and like

stimulants may be used, in connection with the expectorant and diaphoretic powders already recommended in the ordinary sthenic pneumonitis. Senega, eupatorium, &c., are also indicated. If delirium or coma occurs, a proper regard must be had to the brain and nervous system. If the bowels become constipated or relaxed, they must receive attention accordingly. The condition of the kidneys, too, must not be overlooked. The opportunities to aid nature, being, at least, but limited, no means within reach should be neglected.

Section III.

LOBULAR PNEUMONITIS.

This is sometimes called the pneumonitis of young children, for the simple reason that they are specially subject to it. It is, however, not confined to them, but is sometimes experienced by adults.

Pathology.—The disease, when it takes place, is not commonly limited to one lung, but extends to both. Instead, too, of its attacking only the lower portion of the lungs, it spreads itself over a considerable extent. But it does not spread uniformly over the substance of the lung from boundary to boundary. It attacks some lobule or lobules in one part, and then passes over to others a little remote, leaving the intermediate tissue in a healthy condition. As the disease advances, the portions thus inflamed become more and more numerous. Those that were left in health become affected; and, at length, sometimes, the greater part of the parenchyma is found consolidated.

In this form of pneumonitis, the inflammation seems to commence in the smallest bronchial tubes and spread to the vesicles and the several tissues of the affected lobules. Indeed, it is very commonly the sequela of bronchitis in children,—the inflammation of the larger tubes passing to the smaller, and thence to the parenchymatous tissue generally. As the lobules in juxtaposition have no direct bronchial communication with each other, the inflammation has no direct tendency to extend to contiguous lob-

ules. By the course of the tubes, remote lobules are just as intimately connected as contiguous ones; but, after certain ones, however scattered, are inflamed, if the disease continues to extend, it must reach those remaining.

In lobular pneumonitis there is, too, another peculiarity. Sometimes the disease scarcely amounts to inflammation. To a great extent, the lungs are only passively congested, and there are but slight inflammatory traces. Hence, in children particularly, the lobules first and most affected are those at the posterior part of the lungs, simply because the blood, while the child is recumbent, gravitates towards that part. The color is a deep red or brown, and sometimes dark. The part affected is generally darker, smoother, and more imperfectly granulated than appears in ordinary hepatization;—just what might be expected from the coagulation of the blood in the congestion and the obstruction to the process of granulation. Such being the peculiarity of the affection, it passes with difficulty to the stage of suppuration. The pleura, too, is less liable to become inflamed by the progress of the disease, than it is in ordinary pneumonitis; but the bronchi, being earlier affected and more exposed to inflammatory action, secrete the usual viscid mucus of the bronchitis of children.

Diagnosis.—The constitutional and rational symptoms of this disease are, in general, much like those of the bronchitis of children. They give considerable pyrexia or symptomatic fever, generally, a congested state of the capillaries, especially those of the face or of circumscribed portions of its forming patches on the cheeks; but sometimes paleness and lividity of countenance; an accelerated pulse; a painful cough; and a good deal of dyspnœa, manifested by the distention and contraction of the alæ nasi.

The physical signs of lobular pneumonitis, so far as they can be conveniently obtained, are partially, though not very nearly, like those of bronchitis, in its developed stage. There are the sub-crepitant and the mucous rales, formed, in the largest and the medium-sized bronchi, by the existence there not of pus, but of a mucous secretion, as in bronchitis. The respiration seldom or never becomes so completely of the shrill bronchial character, as it generally is in the hepatized part of a lung in ordinary pneu-

monitis. As the disease advances, however, this character is more fully attained, until it, indeed, becomes quite marked. Percussion, at first clear, becomes gradually dull, until it approaches the flatness produced by ordinary hepatization. As it is rare, however, for any considerable portion of the lung, in this disease, to become perfectly solidified, so the dullness does not, at any point, become the most perfect. In estimating the degree of dullness, produced by the disease, in lobular pneumonitis, we labor under one disadvantage. The fact, that both lungs are usually affected simultaneously forbids, in this matter of percussion, the immediate comparison of the diseased with a healthy portion of pulmonary tissue. By having in mind, however, a tolerably correct idea of the resonance which would exist in health, we can, with some degree of accuracy, judge how great is the departure from the normal standard. On the whole, the disease is recognized with an accuracy sufficient for practical purposes. The only essential uncertainty respects the dividing line between the simple bronchitis, with which it usually begins, and that bronchitis attended with inflammation of the pulmonary lobules.

The *prognosis* in this disease, if it is not complicated with other grave diseases, but exists as a simple primary affection, is favorable. The abdominal viscera are liable to be affected, giving rise to indigestion, vomiting, diarrhœa, or constipation. The brain, too, not unfrequently is congested by an obstruction of the circulation; and the consequence is delirium, stupor, or coma. Such cerebral symptoms indicate far more danger than any abdominal. Besides, they conceal or very much modify the pectoral signs, and, in some cases, almost obliterate them. For illustration, while the patient is under the influence of coma, not sufficient nervous power is conveyed to the bronchial tubes to admit of their sensible irritation by their morbid contents, and, hence, the cough ceases. Of course, in such a condition, the true character of the malady is exposed to be overlooked; and the liability to have the most appropriate treatment neglected, constitutes a part of the patients' danger. But sometimes lobular pneumonitis succeeds to phthisis, dysenteria, or other exhausting disease; and then, of course, the prognosis is more unfavorable.

Treatment.—This does not differ materially from that of ordinary pneumonitis,—the doses and the circumstances of their administration being accommodated to the age and condition of the child. The expectorant and anti-febrile treatment, together with a proper regard to all the excretions, is essentially all that is requisite. Revulsives, however, in this disease, should be relied on in the treatment of children, more even than in the treatment of adults. Hence an elm and lobelia poultice, or a paste made mildly stimulating with mustard, or, what I like still better, an onion poultice, may be applied extensively over the chest. Some similar article, too, may be used in the form of *drafts* upon the feet. A frequent use of the alkaline wash over the greater portion of the body is serviceable; and if the pulmonary inflammation produces much heat externally, a wet cloth applied to the chest anteriorly, laterally, and even posteriorly, will have a salutary effect.

In mild cases, however, a copious secretion from the bronchial tubes, with free expectoration, will cure the disease; and nature will sometimes, unaided, effectually employ this mode of cure. If, therefore, the symptoms do not indicate severity, it may be safe to rely on milder means. In such a case, an occasional dose of the compound sirup of lobelia and sanguinaria, the wine of ipecacuanha, the sirup of onions, or some similar expectorant may be all that is essential.

Section IV.

SECONDARY PNEUMONITIS.

Pneumonitis sometimes occurs as the sequela of some other pulmonary disease, particularly of bronchitis and phthisis. In the former case, both diseases consisting in inflammation, the one is, in a sense, absorbed by the other.

The connection, however, of phthisis with pneumonitis is very different. The two diseases have an intimate pathological relation, and cannot be converted directly the one into the other. But the existing tubercles unquestionably embarrass the lung in regard to resisting the progress of inflammation; or, at any rate,

their existence supposes a low state of vitality, such as, if inflammation is once introduced, will afford no very effectual resistance, but will allow the pneumonitis to assume the asthenic form.

Besides, if the inflammation seizes upon the comparatively well lung when the other is tuberculated, or seizes on the comparatively well portion of the lung, the other portion being tuberculated, the patient is, of course, embarrassed in his power of respiration and arterialization of the blood, and is liable to sink in death, as the immediate consequence. If, however, the effect is not directly fatal, still the increased prostration given to the system by the pneumonitis, detracts from its power to carry on the functions of life, and, of course, has the effect to hurry on the progress of the tuberculous disease. Indeed, *post mortem* examinations have shown that the lungs of persons dying of pneumonitis, complicated with phthisis, exhibit the gray tubercles thickly disseminated through the parenchyma. This fact alone is sufficient evidence that the secondary disease has given a new impulse to the primary.

No illustrations of the symptoms of secondary pneumonitis are necessary; nor any special rules of treatment. What I have heretofore said will suggest all that is important.

CHAPTER VI.

PULMONARY EMPHYSEMA.

Emphysema, in Greek εμφυσημα, from the verb εμφυσαω, to inflate, literally signifies an inflation; but applied a little less indefinitely, it signifies a soft tumor arising from air admitted into areolar tissue. In this sense surgeons still use it, to express that puffiness which arises from the admission of air into the areolar tissue, in connection with the occurrence of a compound fracture. In this case, however, the most common source from which the air is received, is the lungs. Suppose, for instance, a rib is fractured, and a bone has broken through the pleura and wounded the lung. The air, passing directly into the areolar tissue, diffuses itself over the chest, neck, and other parts. It may even pass

somewhat extensively over the body. The parts thus affected give a peculiar sense of crackling, when pressed by the fingers.

The disease, however, of which I am now to speak is *pulmonary* emphysema, or air in the parenchyma of the lungs. For brevity's sake, this is commonly spoken of simply as emphysema, —the epithet descriptive of locality being omitted. But emphysema, in this sense, is divided into two kinds, vesicular emphysema and interlobular emphysema. In the former kind, the air is pent up in the vesicles, dilated to a greater or less extent. In the latter, it is effused into the areolar tissue, or held in its meshes, between the lobules, and beneath the pleura.

Section I.

VESICULAR EMPHYSEMA.

Pathology.—The enlargement of the cells, in this case, is very analogous to that dilatation of the bronchial tubes already described. In fact, a slight modification of the causes which produce the one will evidently produce the other. In the normal state, the vesicles are of such a size as barely to be discoverable by the eye; but, when enlarged by emphysema, they very commonly attain to the size of a millet-seed, and may become much larger. Sometimes sacs of the size of a pigeon's or even a hen's egg form; but, in such cases, most unquestionably several vesicles rupture in such a manner as to form one cavity. In other words, they break into one.

The sacs thus formed, by crowding against one another and against the more healthy pulmonary tissue, are made to assume various shapes, according to the accidental pressure. If the surface of a lung affected with vesicular emphysema be examined, the dilated vesicles can be seen through the pleura. Where they are equally enlarged, they appear like healthy vesicles viewed through a magnifying glass. But, sometimes the vesicles of one lobule are enlarged, while those of an adjoining one are of the natural size. In such a case, the emphysematous lobule becomes conspicuous by its protrusion; and the intermingling of those in an abnormal and those in a healthy condition, render the

surface quite irregular and uneven. Sometimes a large globular prominence is seen resembling a small bladder; but this, when examined, will be seen to arise from a depression into the lung of essentially the same size as the elevation without. Of course, a bulla of this kind cannot be passed about, as can the sub-pleural collections of air in interlobular emphysema.

Under the pressure of the finger, an emphysematous portion of lung crackles, like a piece of healthy lung, when dried. The walls of the vesicles, having lost their elasticity, have become rigid. The emphysematous portions, also, are pale,—sometimes almost white. Occasionally, the parietes of the lung appear as if they had been bleached. This paleness is most seen towards the free edges of the lung. "Sometimes these edges are rounded and thick; sometimes thinner and folded back; while, sometimes, the margin is blown out, as it were, into an irregular fringe; some of the inflated portions remaining connected with the lung by slender pedicles, and these forming appendices to it, of a light yellow color," appearing like a fringe of fat. If this emphysematous border be held between the eye and the light, it will appear translucent. If it be punctured, the surrounding parts collapse, proving that the dilated vesicles communicate with each other.

The size of an emphysematous portion of lung is increased, and the tissue becomes specifically lighter, so as to float light on water, like a bladder filled with air. The increased size causes a pressure against the ribs and the intercostal spaces, and distends the walls of the chest at the part corresponding with the distended portion of the lung. There is, consequently, at this part, a protuberance, which sometimes becomes very marked. Sometimes, however, so large a portion of the lung is affected, that one side of the thorax seems generally distended.

The emphysematous portion of the lung, which is generally the anterior margin, becomes comparatively anæmic, while the posterior portion is not so affected, but sometimes even becomes congested in consequence of the attending dyspnœa. In vesicular emphysema, the morbid condition, once introduced, generally continues and gradually becomes worse. The interference with the nutrition of the lung renders it less able to resist the cause of

the affection; and, hence, the disease is almost necessarily progressive.

Vesicular emphysema is very liable to be complicated with other diseases. In the first place, it is probable that bronchitis, either acute or chronic, is usually the leading cause of its existence. The inflammation of the acute form, or the thickening of the membrane in the chronic, it is easy to conceive, may so affect the entrances into the vesicles that, while the air is readily forced in, in inspiration, it does not as readily return in expiration; and, hence, the liability of the vesicles to become permanently enlarged. The air being incarcerated and accumulating in the vesicles, they yield to its distending force and lose their elasticity. If, at the same time, there exists a *hard* cough, the forcible efforts made will increase the difficulty.

But, besides this connection of vesicular emphysema with bronchitis, the former disease is liable to induce the latter, and thus stand to it, in the relation of cause, as well as effect. The embarrassment of the respiration and the agitation produced necessarily determine more blood to the neighboring tubes, producing congestion and the liability to inflammation or bronchitis. The congested or posterior portions of the pulmonary tissue, too, readily pass into a state of inflammation, constituting pneumonitis. Again, the obstruction of the blood in passing through the lungs prevents the right side of the heart from emptying itself freely. The consequence is palpitation, or increased muscular contractions of the right ventricle, followed by a "yielding of its walls to the augmenting pressure of the contained blood." Of course, this embarrassment in the circulation is greatest when the dyspnœa is greatest; but the right cavities of the heart become permanently dilated, and the dilatation leads to anasarca, particularly œdema of the feet and ankles. Finally, the opinion has prevailed, that asthma is induced by this disease; and it is easy to see how the nervous system may become so affected by it as to constrict the bronchial tubes. The manifestations of emphysema, however, so far resemble those of asthma, that the one disease has evidently been often mistaken for the other.

Having referred to one—perhaps the principal—cause of emphysema, I now add farther, that, besides bronchitis, any thing

else which impedes the free exit of air from the lungs may produce it; and, among the other causes, may be reckoned blowing on wind instruments, and pressure made on parts of the lung, as by a tumor in the thorax, an enlarged heart, an aneurism, tight lacing, or a deformed condition of the chest.

Diagnosis.—Among the general signs of vesicular emphysema, an habitual shortness of breath, with occasional paroxysms of extreme dyspnœa, is prominent. In a case of moderate severity, the patient is conscious of a little shortness of breath, on walking up a hill or making some unusual exertion. In an extreme case, the act of ascending a few steps of a staircase will render him breathless. The paroxysms of dyspnœa will frequently occur without any assignable cause, and, when existing, will oblige the patient to sit erect or lean forwards. In such a case, the muscles of respiration are thrown into violent action; the face becomes livid and swollen, and great constriction is experienced at the præcordia.

There is, also, in this disease, a cough which is somewhat peculiar. At first, it is rather dry and wheezing; or there is, to a small extent, an expectoration of thick pearly sputa, but, after paroxysms of dyspnœa are established, there is a more copious ejection of a thin, glairy, and transparent matter. Palpitation of the heart, and that secondary consequence, œdema of the ankles, are also among the general signs of this disease.

The *physical signs* in a well developed case of vesicular emphysema are distinctly marked. They are principally these,—the distention of a portion of the thorax, diminished movements of its walls, resonance on percussion, a peculiar feebleness of the healthy sounds of respiration, and the emphysematous crackling. The last, when heard, is pathognomonic of the one or the other form of emphysema.

The distention of the thorax is necessarily the greatest in those portions in which the dilatation of the vesicles is the greatest, and those, I have already said, are at the anterior margin of the lungs. Hence the anterior thoracic plane becomes decidedly convex. The form of the distended portion is generally rather oval, having its long diameter parallel with the axis of the body. It is,

however, irregularly prominent and unsymmetrical, bulging here and there in correspondence with the enlargement within. If the emphysema becomes extensive on one side, and especially if on both, it elevates the ribs and gives to the whole chest a form nearly cylindrical. But this happens only to those who have long been subject to the disease. The intercostal spaces, in this disease, are elevated more than to retain their ordinary relation to the ribs. The intercostal tissues, being flexible, are pressed up to a level or more with the ribs. The appearance of the clavicle is almost effaced, the spaces above and below are so raised. It is proper here to remark, that the distention of the chest in emphysema is always comparatively moderate, and never attains to that degree which is common in pneumothorax.

The movement of the thorax in vesicular emphysema, is decidedly less than in health. The lung having lost its elasticity, and the vesicles during respiration, remaining distended with air, the thorax necessarily preserves nearly the position which it has immediately after inspiration. Its motion is very limited. This, however, gives rise, to some extent, to that peculiar motion of the abdominal viscera usually termed abdominal breathing.

The resonance on percussion is greater, in vesicular emphysema, than in health, from the fact, that the lung contains more air, and is permanently distended. With persons whose thoracic parietes are thin, the abnormal resonance is considerable; but, with corpulent persons, and especially with those whose advanced age has appreciably diminished the elasticity of the chest, a moderate degree of emphysema will not give much unusual clearness. Over the most dilated portion of the lung, the clearness is always the greatest. Occasionally, where the lung is extensively dilated, the resonance approaches, in degree, that produced by pneumothorax; but the sound, in the former case, is never so tympanitic as in the latter.

In regard to the sounds of respiration, both the healthy bronchial and the vesicular sound are diminished. Before the disease, however, has made much progress, and has not very much compressed the lung, the bronchial sound remains nearly normal; but, in that portion to which the disease has extended, the vesicular sound is completely destroyed. The vesicles, when once filled,

remaining inflated, of course, can give none of the ordinary sounds.

But the pathognomonic sign of emphysema, in one of its forms, when heard, is the emphysematous crackling sound. This is a rustling sound, which nothing but the condition of the lung existing in this disease can produce. It is never heard till the disease becomes severe. Indeed, it is probable, that vesicular emphysema, uncombined with interlobular, never gives rise to it, till numerous sacs are formed from the breaking of one cell into another. Be that as it may, the sound supposes a dry, hardened, and not very pliant condition of the membranes. It may even be, that it involves some inflammation of the parts affected.

Prognosis.—The prognosis, in simple vesicular emphysema, is favorable, so far as prolonged life is concerned. Persons seldom or never die of this disease, alone. Recovery, however, is hardly to be expected; and the danger lies in a complication with other and graver affections. Generally, the progress of the disease is slow and undisturbed. If, however, it happens to be suddenly developed, by the influence of some preceding acute disorder, there may be a partial, though there is seldom or never, a full return towards health.

Treatment.—But little treatment of vesicular emphysema is of any service. Sinapisms, applied between the shoulders posteriorly, and over the dorsal vertebræ may, by their stimulating power, afford some relief in a paroxysm of dyspnœa. The anti-spasmodic effect of the lobelia inflata, too, is favorable. It may be given in common tincture, in doses of twenty or thirty drops. I prefer, however, to combine it with cypripedium pubescens or scutellaria lateriflora. The compound wine tincture, according to the formula, may be given in dram doses, every two hours. To this preparation, twenty or thirty drops of chloric ether may be added, with a favorable anti-spasmodic effect. Opiates combined with nauseants, in sufficient doses to quiet the cough, have been recommended; but the effect of the simple nervines, in connection with the nauseants, is far preferable.

The moderation of the paroxysms is essentially all that should

be aimed at. We know of no means of eradicating the disease. Of course, if it is complicated with other difficulties which are remediable, those should be removed; and circumstances tending to aggravate it may be guarded against.

Section II.

INTERLOBULAR EMPHYSEMA.

Pathology.—The areolar tissue which binds the lobules to one another, is, in its normal state, quite dense and close; but, when inflated with air, it is capable of a good deal of expansion. It is, in this tissue, that the air is found in interlobular emphysema. When the disease is slight, such of the affected parts as are visible on the surface of the lung, appear as little bubbles of air, arranged like beads upon a thread. In extreme cases, however, the lobules are widely separated by the effused air,—the partitions being sometimes, even one inch in breadth. These partitions are broadest towards the surface of the lung, and narrowest in the deepest-seated portions. Indeed, they show an arrangement somewhat like the section of an orange in which the septa radiate and diverge from a centre.

In this form of emphysema, it is common for bullæ to form on the surface of the lung, by means of air in the subserous areolar tissue,—that is, the tissue which connects the pleura with the pulmonary parenchyma. These bullæ may be distinguished from the bladder-like prominences which appear there in vesicular emphysema, and which are dilated vesicles. The former are moved hither and thither, under pressure; the latter are stationary. This sub-pleural effusion of air is sometimes very great. The bullæ are said, sometimes, to equal a hen's egg in size, or even to be larger. "Bouillaud," says Dr. Watson, "mentions a case in which the bladder or pouch was equal to the size of a stomach of ordinary dimensions."

The contents of these sacs are supplied from the air passages, doubtless by the rupture of some of the superficial vesicles. Suppose then, such sub-pleural collections of air, and suppose that, under the pressure, the pleura gives way. The immediate conse-

quence is pneumo-thorax, complicating the emphysema; and this condition of things sometimes, though not often, occurs.

In severe cases of interlobular emphysema, the air readily passes to the areolar tissue of the mediastinum, and thence to the subcutaneous areolar tissue of the neck and chest. In such a case, we have not merely pulmonary emphysema, but emphysema, in a more enlarged sense.

Between vesicular emphysema, and interlobular, there is an important difference in the circumstances of their formation. The former is slowly and gradually established; the latter, suddenly. The permanent dilatation of the vesicles requires time; and they lose their elasticity and break into one another only by degrees. The interlobular effusion of air, on the contrary, may be effected in a few minutes, or even seconds. It is produced by some violence. A woman may so exert herself in childbirth, or a man in lifting some heavy body, that, as a deep inspiration is taken and the glottis is voluntarily closed, some rupture takes place, opening a vesicle or vesicles into the areolar tissue.

Diagnosis.—The general and the physical signs of this form of emphysema are mostly the same as those of the vesicular. The emphysematous crackling, however, is much more extensive and perfect, in this form than in the other. The dyspnœa, too, the distention of a portion of the chest, and the resonance on the percussion of that portion may be greater. But the suddenness with which interlobular emphysema is developed, and the graver character which it assumes, afford the principal means of discriminating it.

Prognosis.—The *prognosis* in this case is very different from that in the other. Under favorable circumstances, the newly developed disease will sometimes cure itself. The rupture, probably under the influence of inflammation and the subsequent granulating process, closes over, and the effused air is absorbed. If, however, this does not soon take place, or if the opening is reestablished and remains, the disease is generally, soon fatal.

Treatment.—But little can be done directly to aid the process

of cure, if it takes place. Equalizing the circulation and quieting the nervous system, so as to allow the reparative process to go on uninterrupted, will be of service. If the disease is terminating fatally, the means of palliating it, or relieving the urgent symptoms, are the same as recommended for vesicular emphysema.

CHAPTER VII.

PULMONARY CONGESTION.

Pathology.—This is an abnormal fullness of the blood-vessels of the lungs, which are situated *anatomically* between the right and the left side of the heart. It is produced, sometimes by general and sometimes by local causes. When the right ventricle of the heart throws more blood into the lungs, than the left ventricle throws over the system, that is, away from the lungs, there must necessarily be an accumulation, and we speak of the lungs as congested. This difficulty arises from various causes. Coughing in pertussis or in severe bronchitis, may arrest, for a time, the circulation in the lungs. Running, straining, or any violent execution, by which the person *is put out of breath* may do the same.

But disordered nervous action will frequently produce a less temporary congestion of the lungs. This remark is applicable to both sexes, though it is mainly illustrated in the case of nervous and hysterical females. *Taking cold* at the menstrual period, habitual amenorrhœa, or almost any disturbance of uterine action, with some constitutions, will be sufficient to develop pulmonary congestion.

There are two very different conditions under which this congestion occurs. One is with females who are of sanguine temperament and plethoric habit, with whom the congestion is of the *active* kind. The other is with those whose tendency is towards anæmia or chlorosis,—whose blood lacks corpuscles, or corpuscles and fibrine, and with whom the congestion, when it occurs, is of the *passive* kind.

Diagnosis.—The indications of this disease are, principally, dyspnœa or hurried respiration, the lungs but imperfectly filling with air at each inspiration; some degree of dullness on percussion, in consequence of the fullness of the congested lungs; and the existence of hæmoptysis or pulmonary hemorrhage.

This last symptom, when connected with active congestion, may be called *tonic hemorrhage;* but, when with passive congestion, *atonic hemorrhage.* Hemorrhage not unfrequently occurs in connection with the existence of phthisis, either at an early period, or more often at an advanced. But, in all these cases, it is to be regarded as a symptom of disease, rather than as disease itself. In phthisis, blood-vessels are invaded by the tubercular disease, and even laid open. In congestion, the case is very different. Sometimes, the smaller blood-vessels, it is true, are ruptured. This is evidently done when the hemorrhage suddenly follows a *straining* or *violent* effort; but, ordinarily, the discharge of blood is an effusion from the mucous membrane of the bronchial tubes. Whether the leakage be from the capillaries, or, as is more probable, from the smallest veins, it is from vessels lying near the mucous surface of the tubes, they being there congested. In active congestion, the blood is too violently forced into those vessels. In passive congestion, the vitalizing power of the blood itself is feeble, the coats of the vessels most often, are morbidly relaxed, and the mechanical pressure of the current within produces an effusion, while there is not sufficient power to force the blood in its proper channels. The existence of the blood in the larger and the medium-sized bronchi, before it is expectorated, causes the mucous and the sub-crepitant rales; but thinness of the liquid through which the air passes, renders the sound sharper and more *snapping* than is that of those rales when made in mucus or pus.

Treatment.—If hemorrhage has occurred, the arrest of that is the first indication to be fulfilled. To effect that object, the internal use of astringents, or astringents combined with vegetable stimulants, is valuable. As astringents, cutechu, kino, tannin, trillium pendulum, and lycopus virginicus are all valuable. The last, most of all, has a special reputation as an astringent and a

styptic. Whatever article is relied on, liberal doses should be given and repeated every few minutes, till the hemorrhage ceases. The addition, in small quantity, of some simple vegetable stimulant, as capsicum baccatum, to the astringent, increases its efficacy. The best known styptic, however, to be employed, whether in hæmoptysis, or in other hemorrhages, is the chloride of sodium (common salt.) A saturated solution of this in water should be prepared; and the patient may drink from a fluid dram to a fluid ounce of the liquid, frequently repeating the dose, till relief is gained. The *modus operandi* of this remedy is not very fully understood. I suppose, however, it acts by means of the stimulating or energizing properties introduced into the blood by venous absorption. In connection with these means, soaking the feet in warm water, swallowing small pieces of ice, and other means of equalizing the circulation are useful. The blood should, as much as possible, be invited and impelled away from the part affected.

In regard to the removal of the congestion itself, and guarding against future hemorrhages, different means are required, according to the existing conditions and causes. If the hemorrhage is the result of violence,—especially, if some of the vessels have been ruptured, rest or the most quiet condition possible should be peremptorily enjoined. The nervous system should be kept quite calm; and, if possible, all severity of coughing should be avoided. Should pulmonary pneumonitis occur, it must be treated accordingly. After this has subsided, if a weakness at the spot remains, gentle local stimulants, as strengthening plasters, may be of some service. But regard to the general health, in the use of simple restoratives, should give the leading feature to the treatment.

In the case of a sanguine and plethoric female, especially if there is menstrual suppression or a partial interruption of the menstrual function, the emmenagogue and depletive treatment is, to an extent, indicated. Hence, agents to produce uterine action and a hydragogue cathartic effect, such as macrotine, podophilline, and the like, are beneficial.

But, in the case of passive congestion, giving rise to atonic hemorrhage, a very different treatment must be adopted. The chlorotic or anæmic condition of the blood requires primary at-

tention. The deficient corpuscles and fibrine must be restored, and thus more vitality be added to the system. Direct and effective emmenagogues used in this case, produce only evil. Agents adapted to produce a healthy uterine action, as the trillium pendulum, macrotine, and the like, will do no injury, but will be favoraqle; but all depleting measures must be avoided. Stimulating drafts applied to the feet, the tepid sitz bath occasionally, and friction to the surface, are beneficial. The vegetable stimulants and bitter tonics, to some extent, are indicated; but the most effective means of removing the disease are the use of iron, in some form, and such vegetable agents as directly improve the vital powers of the blood. Of the different preparations of iron, the iodide, the carbonate, and the sulphate are all valuable; but I prefer the last. Of the vegetable remedies indicated, the compound sirup of aralia nudicaulis and guaiacum wood are among the most efficacious.

CHAPTER VIII.

PULMONARY APOPLEXY.

I use this term for want of a better, though there is an etymological objection to its use. Apoplexy, in Greek αποπληξια, is from the preposition απο *from* and the verb πλησσω *to strike,—to strike from*, or *strike down*. The term is applied to a disease of the brain, under which a person falls suddenly down and lies in a comatose condition, the circulation and the respiration continuing, but the breathing being commonly stertorous. This disease, pathologically examined, was found to consist of a congestion of the blood vessels and an extravasation of blood upon the brain.

When, therefore, it was found that a certain pathological condition of the lungs consists in the extravasation or the effusion of blood into the areolar tissue or the parenchyma, and that the blood remains fixed there, as does that thrown out upon the brain in the cranium, the term apoplexy was, by an analogy not very remote, applied to that pathological condition, and it was called *pulmonary apoplexy*.

Pathology.—In this disease, there must necessarily be, at the outset, congestion of the blood-vessels, to a greater or less extent; but the hemorrhage which occurs is peculiar and characteristic. The blood, instead of passing into the bronchial tubes and being discharged by coughing, is lodged in the areolar tissue, and confined there, or is effused into the vesicles and the terminal bronchial tubes which are situated within the lobules. Sometimes the blood is evidently extravasated, and the pulmonary tissue is broken down or torn. In this disease, there is a clear resemblance between the injury and that which exists in the brain when there is cerebral hemorrhage. Ordinarily, however, there is no such laceration; but the lobules are gorged with blood which has been somehow effused. Pathologists are not agreed to what extent the blood passes directly from the coats of the vessels into the areolar tissue, and to what extent it is poured into the air passages, at or near their terminations. Sometimes, with the induction of this disease, there is no hæmoptysis, though oftener there is, at least, some slight discharge of blood, in connection with coughing.

Now, if the blood is pent up in the areolar tissue, it of course cannot escape. The fact, that there is generally some hæmoptysis, proves that some blood does actually enter the air passages. If the blood mainly, or to any extent, is deposited in the air passages, why is it not thrown out by the cough which the irritation must produce? To this it is replied, that, in the compressed lobules, the nervous energy may be so deadened, by the pressure or other means, that no important degree of irritation is produced; or the bronchial outlet from each lobule may become compressed or blocked up with coagulated blood so as not to allow of an evacuation.

This disease, like the congestion already considered, has been very commonly referred to the effect of a contracted mitral orifice —not allowing the blood to return, from the lungs, with sufficient rapidity. But, though this will account for the congestion of the pulmonary apoplexy, except the ordinary pulmonary hemorrhage and hæmoptysis, yet if the blood is effused directly into the areolar tissue, the cause must be sought in the pulmonary parenchyma, and not in the heart; and, if the effusion is direct into the term-

inal air passages, and yet there is little or no tendency to hæmoptysis, the cause of that peculiarity must be sought for in the lungs themselves. Some consider that the disease is connected with the capillaries rather than with the larger blood-vessels, and that it differs from inflammation mainly in the blood's lacking the phlogistic and reactive character of inflammation. It appears that there is a weakness in the vessels and the tissues concerned, by which the blood *leaks* or *oozes* into its place of deposit, and little or no vital reaction is established.

Dr. Thomas Watson thinks there is sufficient reason for considering the blood in pulmonary apoplexy to have been first poured into one or more of the larger branches of the bronchial tubes, and then to be driven backward into the pulmonary lobules by the convulsive efforts which the patient makes in respiring, or by paroxysms of coughing. He thinks that clots of blood found to exist in different and distinct parts of the lung, at the same time, are phenomena to be explained in this manner. When the texture in some of the lobules is lacerated, he thinks that the lesion happens through the violence of regurgitation on the part of the blood in the bronchi. In support of this view, he relies mainly on the fact that the body of a person who died of a rupture of the lingual branch of the carotid artery, while suffering from tonsillitis, exhibited, at the *post mortem* examination, hard, dark and small masses of blood, scattered through the parenchyma of the lungs, as well as clots about the trachea and glottis. The doctor takes it for granted that the blood forming these masses in the parenchyma passed there, from the lingual artery through the trachea and bronchi, and hence concludes, that all such masses are formed from blood received through the bronchi leading to the places of their existence. According to this theory, it might be inquired, how the engorged condition of the lung should take place, and yet no hæmoptysis whatever occur, as sometimes happens; but the subject is one on which, it seems to me, we need more light.

When the lung in the condition of pulmonary apoplexy is examined, there are generally found hard knots or compact masses, situated here and there, mainly in the lower lobe and towards its posterior surface. These knots are of a dark red or brown color,

and are of different sizes, ranging from the size of a pea or small marble to that of a hen's egg. When cut through, they show a circumscribed surface, in strong contrast with the surrounding tissue. They are evidently composed mainly of deposited and coagulated blood. As the different lobules have no direct communication with each other when the masses become large, they are evidently formed by the engorgement of several lobules in proximity.

Sometimes there are but few small masses or nuclei. The disease consists mainly in the existence of one large diffused mass, occupying nearly the whole of one tube, but having limits obscurely defined,—the color gradually deepening in the course from the border to the centre. In this case, the central portion is obviously formed almost solely of a black clot of blood; while, at a distance from the centre, the sanguineous deposit is more diffused and intermingled with the pulmonary tissue.

Diagnosis.—The symptoms of pulmonary apoplexy are not constant. Among those which more generally appear, are dyspnœa, a sense of tightness or a dull pain in the chest, a cough, and hæmoptysis. The blood expectorated may be a mere tinging of the sputa, or a little pure blood raised in coughing. Often, however, in this disease, there is little, sometimes no hæmoptysis, the effused blood coagulating and remaining undisturbed in its place of deposit.

Among the physical signs is feebleness or absence of the vesicular sound over the part affected. If the disease is extensive, the sound will be almost entirely wanting in the lung. At the same time, the respiration may partake decidedly of the shrill bronchial character, especially towards the root of the lungs. In one remarkable case which came under my treatment, the air-passages of the right lung were so completely blocked up, that no sound of respiration whatever was heard, except over the largest bronchi, and the superior lobe. Of course, what sound there was, was of the shrill bronchial character. When sufficient hemorrhage takes place, or blood is found in sufficient quantity in the medium-sized bronchi, the sub-crepitant rale is heard; and, in the largest bronchi the mucous is also heard, if there is sufficient

liquid there to produce it. These rales, of course, have the peculiar character given them by the thinness of the liquid.

If the disease is slight, there will be, on percussion, a slight dullness only; but, in graver cases, the dullness will be considerable. In the unusual case to which I have just alluded, there was dullness amounting almost to flatness, all over the lower half or more of the lung, anteriorly, posteriorly, and laterally. Indeed, the percussion was hardly normal on any portion of the right side of the thorax. This case commenced suddenly in the night, after exposing the chest and taking cold the previous evening. There was, at first, a slight hæmoptysis, but hardly enough to create the sub-crepitant rale; and some febrile symptoms lasted for a few days. In one year, symptoms of tuberculous disease developed themselves; and in six months more the patient died of phthisis. Whether this disease, in its incipient state, was there in the first place, cannot be known. Possibly latent and incipient tubercles might have assisted in producing the pulmonary apoplexy.

Prognosis.—The *prognosis*, in the case of pulmonary apoplexy, is not very favorable. The disease supposes an antecedent serious affection of some sort, or perhaps a complication of affections. By its irritation, also, and its disturbance of the function of respiration, it almost necessarily leads to other ill results.

Treatment.—If there is hæmoptysis, that is to be arrested, as described in the treatment of congestion. If febrile action is excited, that should be treated as in other cases. But, in regard to the removal of the coagulated blood, remedial means can accomplish but little. Simple expectorants and demulcents to relieve the air passages and allay irritation, may prove palliative. If there are complications of other diseases, they should receive proper attention, and so should the general health of the patient.

CHAPTER IX.

PULMONARY GANGRENE.

I use the phrase pulmonary gangrene, in accordance with common professional usage. Pulmonary mortification, however, would be a more appropriate designation, as the phrase is not intended to be limited to a partial destruction of the parts, but simply to an entire loss of vitality and sloughing.

Pathology.—Pulmonary gangrene may occur either as a primary or a secondary affection. When it is primary, it results from a reduced state of the blood, in which the vitality or nutrition of the part is not sustained. As a secondary affection, it occurs sometimes in asthenic pneumonitis. In the primary form, the diseased part is, at first, infiltrated with a thin serous liquid which is an exudation dependent on the incipient gangrene. In the secondary form, the tissue in the beginning, is hard and congested, and situated in the midst of an inflamed portion of the parenchyma. This difference of anatomical character in the part affected, at the outset of the disease, is essentially all that distinguishes the primary form from the secondary. They soon assume essentially the same appearance.

Sometimes the disease occupies a large portion of the lung; and sometimes it is quite limited. Like pneumonitis, it generally begins in the lower half of the lung. The color of the part that has perished, is mostly a dirty olive color or greenish brown. The part becomes moist and of the consistence of an engorged lung, or softer. Sometimes, it is even diffluent.

Sometimes the disease of pulmonary gangrene has been divided into three stages. The first embraces the period in which the mortification is just fully established; the second, that in which the tissue begins to break down; and the third, that during which a cavity exists. After the explanation which I have elsewhere given of the nature of mortification, the pathology of pulmonary gangrene needs no further illustration, except to say, that, recovery takes place from the third stage only; and, when it begins, a

line of separation and a kind of membrane forms between the healthy and the mortified tissue. As the gangrenous portion sloughs, this membrane becomes a kind of lining to the cavity; and, while the cavity communicates with the bronchi, the membrane gives origin to the formation of pus; and, though delicate as a serous membrane, it has rather the character of a mucous. After the communication is closed, the membrane assumes a character more distinctly serous; and then the cavity is gradually obliterated by the formation of areolar tissue within the cyst, or else it remains, without closing, during the individual's life. After a cure of the gangrene, the portion of the lung which has been involved in the disease, is liable to remain for a long time, more or less dense, and to receive somewhat less than the normal proportion of air.

As a cavity is forming, the bronchial tubes resist the destructive process longer than the areolar tissue; but the blood vessels generally hold out long after the bronchi have yielded. On a *post mortem* examination, they are frequently seen traversing the cavity. At length, however, they too are destroyed; and, sometimes, their destruction gives rise to hemorrhage, though generally, they do not slough, till after the blood has ceased to circulate in them.

The immediate *cause* of primary pulmonary gangrene, is, doubtless, the influence of vitiated and poorly vitalized blood. In the secondary affection, too, there must be substantially the same condition. The remote or ultimate causes are intemperate habits, neglect of nutritious and wholesome diet, and all such circumstances as tend to diminish vitality or break down the general health of the patient.

Diagnosis.—The general signs of pulmonary gangrene are fever, with a small, frequent, irritable, and sometimes exceedingly feeble pulse; loss of appetite from the nauseating character of the gangrenous liquid which is swallowed; sometimes diarrhœa from the effect of the same liquid; dyspnœa often extreme; and a peculiar pale or lead colored condition of the whole skin of the patient.

The more local signs of this disease, are cough, expectoration, and fetor of breath. The cough, at first, resembles that of ordi-

nary bronchitis, but becomes more loose and paroxysmal, with the progress of the disease. The paroxysms are caused by an accumulation of fluid in the bronchi, inducing an effort to throw it off; and hence, as soon as the object is gained, the effort ceases, until a new accumulation renders another effort necessary. These paroxysms of coughing, are sometimes very disturbing.

The sputa in the second stage begin to contain gangrenous matter; and, during the third stage, they remain about the same, until that matter is all discharged. They consist of a thin fetid liquid which not unfrequently is stained with blood that flows from sphacelated vessels. This liquid is pathognomonic of the disease. If the case proceeds to a fatal termination, the sputa increase in quantity, while the patient is gradually sinking. Dr. Gerhard says, "there are two principal varieties of the gangrenous sputa. One consists of a dark thin liquid which sometimes resembles tobacco juice or the infusion of licorice, occasionally containing small pieces of black gangrenous lung. The other consists of a grayish-yellow pasty fluid which is probably a mixture of pus and gangrenous liquid. The latter occurs most frequently in cases following pneumonia. Both, however, are extremely fetid, though the odor differs slightly."

The fetor of the breath is peculiar, and it begins to appear even in the first stage of the disease. It is greater, however, in the second and the third stages, in which the sloughing process is going on. This fetor, as well as the sputa, is pathognomonic of the affection; and the former is sometimes so extreme, as to render the room of the patient scarcely endurable.

The physical signs, previous to the third stage, are very limited. The thin serous liquid which exudes, in primary gangrene, from the affected portion of the lung, may be sufficient to give a subcrepitant and a mucous rale, as it passes through the tubes; but if the disease be limited to a small space, and that deep-seated in the lung, the healthy sounds of respiration will be heard as usual. If the disease be extensive, the current of air in the air passages being prevented, the respiratory sounds at the part will be suppressed. Percussion generally maintains about the normal resonance, though the pulmonary tissue, infiltrated with serosity, may yield a considerable degree of dullness.

After a cavity has formed, the auscultatory signs are the gurgling rale, cavernous respiration, and pectoriloquy. Besides the gangrenous exudation already referred to, and which continues till the mortifying process is arrested, there is the formation of pus, as soon as the vital powers get the ascendency. Of course, when the cavity is of considerable size especially, the quantity of liquid exuding from the walls is sufficient to give a loud and constant gurgling,—one the extent of which is scarcely equalled in tuberculous disease, as in that cavities are rarely so large and do not give rise to so much liquid.

When the gangrenous matter is expectorated and the cavity is evacuated, cavernous respiration and pectoriloquy appear. The former is generally full and distinct; but the latter, unless the cavity is large and near the surface, has not as clear a resonance as is afforded by the harder walls of a tuberculous cavity. Such, however, may be the size and situation of a cavity, as to give amphoric respiration and full pectoriloquy.

Percussion is resonant in proportion to the size of the cavity over which it is made, and the proximity of the cavity to the surface. If a considerable portion of the lower lobe of the lung is destroyed by the gangrene, the resonance will be very great.

When gangrene of the lungs is being cured and cicatrization is taking place, the signs of a cavity disappear, and are replaced by the sub-crepitant and mucous rales made by the muco-purulent matter in the tubes. Bronchial respiration and bronchophony next appear, and finally give place to sounds nearly normal. The vesicular murmur, however, remains for a long time feeble, and very commonly never fully returns. The normal resonance on percussion, in due time, re-appears.

Prognosis.—The *prognosis* in this disease depends very much on the situation of the patient. In private practice, the patient being properly treated and nursed, recovery is effected in a majority of cases; but, in hospitals and other places in which proper attention is not paid, the chances are on the side of death.

Treatment.—In primary pulmonary gangrene, the treatment must be of a *supporting* character. Hence tonics and stimulants,

in connection with expectorants, are indicated. As an expectorant, nothing is better than the compound sirup of lobelia and sanguinaria. As tonics and stimulants, peruvian bark, polygala senega, and asarum canadense are good. Even wine, porter, and nutritious food may be freely given.

When gangrene succeeds inflammation of the lungs, or comes on in the course of pneumonitis, more regard must be had to the febrile symptoms. Indeed, the ordinary treatment of pneumonitis must be adopted, with some modifications. The active tonics and stimulants will not, to a great extent, be well borne. The anti-febrile corroborants should be freely employed, such as asclepias tuberosa, corallorhiza odontorhiza, and agents of that class are of great importance.

In this disease anti-septics are valuable, such as charcoal, yeast, &c. A solution of chlorinated soda, unless it proves too laxative, may be given, in doses of ten or twenty drops, every three or four hours. Chloride of lime, too, may be placed in the patient's apartment and near his head. It will add to his comfort, and favor his recovery.

The usual regard should be paid to the secretions generally; and, in some cases, an irritating plaster or other external stimulant is of service. In general, however, but little reliance can be placed on external applications.

CHAPTER X.

PULMONARY ŒDEMA.

Pathology.—This is generally described as an effusion of serum into the areolar tissue of the lungs. It is doubtless true, however, that a portion of the effusion is into the vesicles and the smallest bronchial tubes. In general, the characteristics of pulmonary œdema are like those of dropsy in the areolar tissue, in any other portion of the system. In fact, the disease is a form of anasarca.

When it exists, it generally affects both lungs nearly equally; and, like anasarca elsewhere, it is first discovered in the most dependent portion of the tissue concerned. This is simply the effect

of gravitation, the meshes of the tissue not forming perfect cells, but containing interstices communicating with one another.

When a portion of an œdematous lung is examined, it is found to be of a pale gray or yellowish color; it is heavier than healthy lung; it pits on pressure; and it has a peculiar crepitation. When incised, it emits a spurious and transparent liquid which, when fully expressed, leaves the lung in an apparently healthy condition. The texture of the organ is thus proved sound; while its increased density and diminished ability to contain air, are shown to result from the presence of the contained fluid.

Pulmonary œdema is a lesion not very unfrequent with the aged, though it is often to be regarded only as a part of general dropsy. It sometimes, however, appears,—not, perhaps, as an idiopathic disease,—but as the principal manifestation of a dropsical tendency. It has sometimes proved the immediate cause of death at the termination of a fever which has been badly treated and in which the blood has become watery and deprived of its vital properties.

Diagnosis.—Dyspnœa is a *general* symptom of this disease; and the evidence from this of existing pulmonary œdema is strengthened, if there is anarsaca or evident dropsy of other parts of the system. Generally, the expectoration is not great. What is raised is chiefly aqueous fluid, a little foamy, and containing some floating mucus. Sometimes, however, a very considerable amount of liquid is coughed up and otherwise expectorated. In one marked case of the disease, ending fatally, I saw the patient a little before and after death, which was sudden. There was general dropsy; and, after death, a good deal of watery fluid was pressed from the lungs out of the mouth.

The prominent *physical* sign is a coarse crepitant rale, heard at the base of the lungs, or, if the disease is extensive, over a considerable portion of them. The bubbles of this rale are somewhat coarser than those heard in pneumonitis; but they break even more rapidly, and do not extend in long trains, from one point to another.

Percussion is but little altered. With the liquid, there is sufficient air in the lungs to give nearly the ordinary resonance. At

any rate, as both sides are alike affected, we have not the advantage of comparing a diseased with a healthy lung, and cannot, therefore, as well judge what is the normal sound.

Prognosis.—The *prognosis* in this disease is generally unfavorable. If the lungs are extensively affected, as shown specially by the peculiar crepitant rale, there is but little room to hope for essential improvement.

Treatment.—Like other dropsies, pulmonary œdema generally arises from disease of the heart, or obstruction of some large blood-vessels. The immediate cause, therefore, must be sought out, and, if possible, removed. As palliative, rather than curative means, diuretic and diaphoretic medicines may be administered :— also, if the debility of the patient does not contra-indicate, hydragogue cathartics. Of course, his strength must be sustained by vegetable bitter tonics, so far as they are well borne.

CHAPTER XI.

PLEURITIS.

The term *pleuritis*, synonymous with the more common word *pleurisy*, signifies inflammation of the pleura; and pleura, in Greek, πλευρα, signifies the serous membrane which lines the internal surface of the thorax and covers the viscera. Like pneumonitis, pleuritis never takes on a form so distinctly chronic, as that which bronchitis sometimes assumes. It sometimes, however, becomes an asthenic and latent disease, and sometimes comes on as the *sequela* of some other affection. In its usual form, it may be regarded as a primary or idiopathic, and a sthenic disease. As such, it is properly called *primary sthenic pleuritis*.

Section I.

PRIMARY STHENIC PLEURITIS.

As the simple term *pleuritis*, without any qualifying epithet, is generally employed in this sense, I shall, for brevity's sake, so use it; and only use qualifying words to express other modifications of the disease.

Pathology.—Pleuritis, in the sense of a primary and sthenic disease, is divided into two stages. The first is the stage of *inflammation*. When it commences, the small blood-vessels beneath the pleura, are distinctly visible through that transparent membrane, being interwoven in various directions, and forming a thick net-work of a bright red color. When this membrane is detached, it is found to be but slightly changed in appearance,—the development of the inflammation being really, in the main, in the sub-serous areolar tissue, rather than in the serous itself. The truth is, serous tissues generally differ from mucous, in being thinner, more delicate, and supplied only with the very smallest blood-vessels, such as do not transmit the red globules of the blood; whereas some of the branchings of the arteries of such size as to convey the red globules, and be easily traced, pass into mucous tissues. As in all cases of inflammation, effusion or extravasation is liable to occur; so in pleuritis, bright red spots of blood, effused or extravasated from the vessels, are sometimes quite numerously seen.

In pleuritis, we cannot trace the gradual progress of the inflammation and the consequent change of the symptoms, as in bronchitis. The delicacy of the parts concerned, and their connection with the nervo-vital fluid, cause the inflammation rapidly to reach its height; and then the reparative process, mostly in the granulating form, is soon established.

The second stage, which is that of *effusion*, commences at this point. If my readers have made themselves familiar with my views of the reparative process, and its connection with inflammation, as illustrated in the first Division of the first Part of this work, they will see how beautifully the pathology there given is

illustrated in the progress of the disease, pleuritis. Authors have generally spoken of a secretion of two kinds of matter, at the commencement of the second stage. They speak of a liquid serous secretion, and a secretion of albuminous matter or plastic lymph, deposited upon the pleura in little flocculi, but liable to be rubbed off and to sink, with the serum, to the most dependent portion of the thorax. The serum and the lymph are supposed to be secreted in different proportions, in different cases of pleuritis, —the former being very small in amount, in some cases, called those of dry pleuritis, while, in other cases, it is very abundant, and fills almost the whole pleural sac. The serum is of a whitish or yellowish color, and never perfectly limpid. It is clearly the watery or essentially the unorganized portion of the blood. In regard to the "effusion of lymph," as it has been called, Dr. Gerhard speaks particularly, in connection with some reference to the serous deposit. He says, "This effusion, the effusion of lymph, is at first deposited on the serous surface, in minute points, which are transparent and scarcely visible, but may be readily detected by the touch. These points, as they become more numerous, gradually collect into groups which, finally coalescing, form a continuous membrane. The deposit of lymph has received the name of a false membrane, and is more abundant at the lower portions, where it is, in some cases, as much as a fourth or even half of an inch in thickness, while, at the upper portion, it seldom exceeds an eighth of an inch. The character and the amount of the effusion vary, according to the form of the disease and the constitution of the individual affected. In cases of local pleurisy, especially if occurring in robust persons, the amount of serum effused is very small, while there is a considerable deposit of lymph. The same, also, occurs in persons who are not robust, when the inflammation is confined to a small portion of the membrane. On the contrary, if the patient be thin, and of a lymphatic temperament, and the inflammation diffused, the effusion of serum will be very great, with but a slight trace of lymph. The thin and serous part of the effusion tends to diffuse itself over the surface of the pleura, gravitating to the most dependent portion, and shifting its position, with the movement of the patient. When, however, it is principally composed of lymph, it is

confined to the part of the lung which is affected, and exhibits no such tendency. The serum increases in quantity, as the disease advances, and decreases with its decline. But the lymph is more persistent in character; and, instead of being removed, becomes organized, and assumes the character of a serous or cellular membrane, according to the circumstances in which it is placed."

This quotation from Dr. Gerhard, contains substantially the views of pathologists generally on this subject; and to my own mind, it seems strange, that they could have mistaken the truth for so long a time, and yet not have fallen upon it, in all its simplicity.

In the deposit of the hyaline fluid, and the formation of new tissue, it will be remembered, that the liquor sanguinis is at first secreted. This is composed of a little less than three parts of fibrin, and more than eight hundred and fifty of serum in one thousand parts of blood. The fibrin is essentially the only portion used in forming the hyaline deposit, while the serum, not entering into the vital economy, has to be otherwise disposed of. When a surface exposed to the external world heals, the serum is mainly evaporated; but in a shut sac, like that of the pleura, it must either be absorbed or fall to the bottom. In persons possessing a good deal of vital energy, the absorption may go on nearly or quite as fast as the serum is separated from the fibrin; and hence the pleuritis is called dry. In persons of a lymphatic temperament or those whose general health has become much impaired, the power of absorption will be diminished, while the blood itself, from which the hyaline fluid is taken, is liable to have too small a proportion of fibrin, and too large a proportion of serum. Of course, under these circumstances, there must necessarily be a collection of serum in the pleural sac.

In the formation of false membrane, as it is called, I have elsewhere explained, that the process is only the granulating process, or union of the parts by granulations. This, too, I have said, is mainly a vital, though in part a chemical process. It shows the disposition of tissues to heal, not by means of inflammation, but in spite of the existing inflammation. In the case of the pleura, the exudation corpuscles appear on the surface, at first in distinct points; but they accumulate near together, and finally form a

membrane. The rubbing of the two parts of the pleura together, fritters away a portion of these exudations, and they mingle with the serum collected in the sac. The fact that the pulmonary and the costal portions of the pleura often unite, is strictly *an accident.* They being in contact, while the reparative process is going on, cannot escape the accident, except the rubbing of the parts together in respiration, prevents; but this is not likely to obviate that result. While there is a collection of water in a portion of the cavity, that prevents the accident; but, after the water is absorbed, it generally occurs.

As the serum is absorbed in the progress of recovery, the pressure of the atmosphere without, forces the parietes of the thorax towards the lung, and adhesion takes place between the two surfaces of the pleura. The lung is compressed against the spine, and, in that position is covered with exudations or false membrane, so that it cannot afterwards rise to meet the ribs. When the pleuritis is slight and the effusion small, there is little or no contraction of the chest. If there is some, at the time, it does not remain permanent, but, after a while, the lung expands in a good degree.*

But when the pleuritis is severe, and the effusion great, the size of the lung by the pressure of the effused fluid, is greatly diminished. To its normal dimensions after a very great compression, it seldom returns. And yet, by this, its structure is often unaffected. In appearance, it is wrinkled and flaccid, not crepitating, and containing but little blood. By surrounding inflammation, it is but little affected. For the tendency of serous inflammations to implicate subjacent tissues, is but slight. Air forcibly blown into its branches, readily distends it nearly to its original size. Sometimes, however, its vesicles adhere, and thus the ingress of air is prevented. Then it looks like a piece of flesh, and is said to be carnified. The small size to which the lung in the chronic form of the disease, is sometimes reduced by the effusion, and its concealment beneath thick layers of false membrane, led the ancient pathologists to conclude, that the lung itself was entirely destroyed by suppuration.

* Here ends the writing of Dr. Newton.

Such a degree of atrophy remaining permanent, after the absorption of effusion, would, of course, cause a vacant space in the chest, and this gives rise to contraction of its walls, and to an elevation of the subjacent viscera, the degree of which will depend upon the size of the space, left vacant by the removal of effused fluids.

The quantity of effused fluid varies from a few ounces to several pints. When very copious, it fills the cavity of the pleura, and, in some cases, has been known in the course of a few days, largely to distend the chest, to cause the intercostal spaces to become more prominent than usual, and by its pressure to displace the adjacent viscera, whether of the thorax or abdomen. But these results more frequently take place in the more protracted cases which more properly may be described under the head of chronic pleurisy.

In the sthenic form of the disease, the distension is rarely very great. In character the liquid is usually yellowish, limpid, or slightly clouded with flocculi of concrete albumen floating in it. Often it is turbid, like whey, sometimes bloody with or without coagula. In short, its color generally varies according to the variable quantity of its contained blood or of its red globules. In the progress of the disease, there are, moreover, mingled in the effusion, more or less of coagulable lymph and pus. In ordinary cases it has but little odor. This, however, is not always the case. Gangrene of a portion of the lung, or the admission of air into the pleural sac, constituting pneumothorax, often makes its odor most offensive from the generation as some suppose, of sulphureted hydrogen gas by decomposition.

During the progress of the disease, the proper serous membrane, or the epithelium upon the areolo-fibrous layer, is not thickened or materially softened. In fact, the inflammation of serous membranes generally is located in the areolo-fibrous layer, because this is vesicular, and, therefore, more subject to inflammation. Whether or not the pleura pulmonalis is more liable to take on inflammatory action than the pleura costalis, authors, generally, to my knowledge, do not express an opinion. That pneumonitis often extends inflammatory action to the pleura, and that tubercular deposits, adjacent to the surface of the lung, often cause a sim-

ilar effect, are facts well known to medical men. And hence, it seems reasonable to conclude, that inflammation at first more often affects the pleura pulmonalis, and that the affection of the costal membrane is secondary.

The adhesions of some parts of the lung are more strong, and more often occur than those of others. Whether or not adhesion shall take place at all, will depend on the quantity of serous effusion, and the character of its coagulable lymph poured out on the pleural surfaces. Of course, the fluid would ponderate to the lowest part of the chest, and pressing apart the two surfaces of the pleura, would prevent adhesion. If the upper portion is inflamed, and the fluid is not so copious as to fill the entire pleural sac, the part of the lung above the surface of the fluid, will adhere, while the parts below will remain free. But if the pleuræ be inflamed in their lower portions only, a moderate quantity of liquid will be enough to keep their surfaces separate ; and, if the lymph then becomes organized, it forms, not an adhesion, but a false membrane coating the lung, which may have effects in modifying the remains, or the products of previous inflammation.

A second condition modifying the liability to adhesion, is the composition of the coagulable lymph. If this contains a large proportion of what Mr. Paget calls the fibrinous lymph, or, in other words, if the lymph partakes more of the *fibrinous*, than of the corpuscular character, the liability to early adhesion will be increased. When little or no liquid exists to prevent contact of surfaces, the union, when the fibrinous lymph is exuded, takes place in a short time. As absorption removes the fluid, the lymph becomes organized, adhesion is the result, and in this manner, many times nearly the whole pleural sac is obliterated. When this is the case, that side so affected is not liable afterward to take on pleuritic inflammation. In some cases, the adhesion is only partial. Sometimes filiaments of cellular membrane are seen extending from one surface to the other, having been formed, probably, during the plastic state of the effused lymph, by the movement of the lung upon the side of the chest in respiration, drawing out the lymph into slender connecting bands.

There are cases in which, contrary to common experience, the lower parts of the lung are firmly bound down to the parietes of

the chest, while the upper parts are free. A new attack of pleurisy on the same side, under these circumstances will, of course, cause effusion from the upper and free surface of the lung, and in this way give rise to abnormal sounds on percussion, in a locality, where by the inexperienced physician, they would not be suspected.

Another effect of pleuritis is the formation of pus. This, however, in cases of sthenic pleurisy, is gradual. In the advanced stages only, it assumes the character of pure pus. In fatal cases terminating after a few weeks, the effusion is thin, and is evidently composed in part of serum. And hence it has received the very appropriate name, *sero-purulent* effusion. It is probable, also that in the earlier stage of the disease, a certain number of pus globules exist in the effused serum.

"Sometimes, in persons of feeble constitution," says Dr. Swett, "there are cases which, if measured by the time the disease had existed, would be called cases of chronic pleurisy, but, in which after death an abundant serous effusion, and but very little lymph or pus exist."

Such cases seem to be developed by the existence of a low degree of inflammatory action which does not advance much beyond the effusion of serum, but which, occurring in feeble constitutions, and developed insidiously, is protracted to a fatal termination. On the contrary, the formation of pus is not always so protracted as before described. When the inflammation is violent, in its character, pus may be secreted in the acute stage of the disease, and a fatal termination is quickly the result. The existence of pus alone in the cavity of the chest, cannot, therefore, be justly considered as a sure indication of the stage of the disease. For the time of its formation depends very much upon the constitution and temperament of the patient. Cæteris paribus early adhesions, instead of copious effusion of serum, or the formation of pus, take place in mild cases, and in the young, strong and healthy. On the contrary, in the feeble, old, and scrofulous, the effusion of serum of a puriform character more frequently occurs early in the disease. The cause of this is found in the varied character of the effused lymph. In the young and plethoric, in those whose blood is rich in fibrin, the fibrinous lymph—using the division of lymph as made by Mr. Paget—is most commonly effused. While

in persons having blood of an opposite character, the effused lymph partakes more of the corpuscular or less vitalized form which, very readily, and with but little change, degenerates into pus.

Diagnosis.—*General and rational symptoms.* Acute sthenic pleuritis usually commences with a chill, soon succeeded by an acute lancinating pain in the side, cough, short and quick breathing, and fever. Each of these will receive a particular notice.

The *pain* may come on either before, at the same time, or a short time after the chill. In character, it is severe as if resulting from the thrust of an instrument, and hence, it is often called a *stitch* in the side. Usually it is felt somewhere in the mammary region. But sometimes, elsewhere; sometimes near the lower margin of the chest, in which case it is, probably, the result of inflammation of that part of the pleura which covers the diaphragm. In most cases it is confined to one place, but it may be diffused over the surface of the chest, when it is sudden, very sharp and severe. It is so nearly simulated by the nervous pains of hysteria, that it may lead to error in diagnosis. By inspiration, cough and motion, it is increased. Generally, lying on the affected side, and pressure over the intercostal spaces, aggravate it. There is, a day or two after the occurrence of the most severe pain, a greater degree of soreness externally, than when early in the disease, the pain is most acute. As the effusion increases, the pain decreases in consequence of the separation of the inflamed membranes by the fluid, and the prevention of friction. It is, in some cases, almost entirely wanting, being perceptible only as soreness on pressure.

The *cough* is usually short and dry, attended with but little expectoration of mucus or frothy matter. Sometimes a more copious expectoration is present. When the pleuritis is complicated with a degree of bronchitis, it is occasionally, somewhat bloody. Severe pain often attends it, to avoid which, the patient tries to suppress the cough, and to a certain extent he succeeds by the effort. This, however, in some cases is wanting. When such is the fact, and there is at the same time no pain, the disease by some authors is called *latent pleurisy*.

The *breathing*, in most cases, is more or less difficult. The pain prevents a full, deep inspiration. The patient is said to have a *catch* in his breath. In consequence of this, less air is taken into the lung when the pleura is affected, and the frequency of respiration is therefore increased inversely as the quantity of inspired air at each inspiration decreases. The dyspnœa, unlike the pain, increases as the disease advances. The effused fluid filling up the space, usually occupied by the lung, causes this symptom. The function of one lung is more or less suspended, and the action of the other is increased beyond its normal degree; so that the breathing of the patient becomes painful, and difficult. This is more particularly the case, when the effusion is both sudden and copious. When gradual, the system accustoms itself to the abnormal conditions of the respiratory organs. In the latter stages it is most severe.

The decubitus has been considered as a pathognomonic sign of the disease. Yet there is much variance among the opinions of observers in respect to this symptom. This results from the variation of the decubitus in the different stages of pleuritis. At first, the patient cannot lay upon the affected side, on account of the increase of pain which that position produces. At a later period, when the effusion separates the inflamed surfaces, the pain, resulting from the position of the two portions of the pleuræ, becomes less, and sometimes is entirely wanting. When the decubitus is on the sound lung, the weight of the effused fluid, pressing upon the mediastinum, and forcing this beyond the median line, preventing the ingress of air into the sound lung, causes pain from dyspnœa. And, consequently, at this period of the disease, the decubitus is most free from unpleasant sensations on the affected side.

The *fever* is usually considerable, and attended with the most common phenomena of febrile affections. The pulse is quick, sometimes rising to over a hundred beats in a minute, hard, full and tense. The skin is dry and hot, particularly over the chest, or the seat of the disease.

The tongue is parched; the urine is scanty and high colored; and occasionally there are cerebral symptoms. Of the fever there are often daily remissions and exacerbations, the former coming

on in the morning, the latter in the afternoon or evening. In four or five days it moderates considerably.

"*The physical signs*, at the commencement of the attack, are nearly normal. Before effusion has taken place, percussion is quite clear, and no auscultatory sign is given, except a slight diminution of the respiratory murmur, consequent upon the deficient expansion of the lung, which is rendered more evident by a comparison of the two sides. As this depends nearly upon the pain of inspiration, it is obvious that the same result must take place in all other cases in which the pain is equally acute, and especially in pleurodynia; so that the sign is of no great value. But very soon after the onset of the disease, when the concrete exudation has had time to cover in some degree, the surface of the membrane, a peculiar and characteristic sound may often be heard, in the middle portion of the chest. Sometimes it is accompanied by a tremor when the hand is applied to the affected side. This is the *friction sound*, produced by the rubbing of the opposite roughened surfaces against each other. It is thought that the sound may be developed even before the commencement of exudation by the rubbing together of the pleuritic surfaces, rendered dry by the commencing inflammation, or unequal by the enlarged vessels. The grating movement which gives rise to the sound, may be felt by the hand applied to the side. As the conditions upon which the sound depends, are of short duration, the sign must be evanescent. It must vanish whenever a union of the opposite surfaces takes place, or as soon as they are separated by the liquid effusion. Although, from its uncertain occurrence, and its fugitive character, it cannot always be depended on, yet, when observed, it is a valuable sign, especially, in cases unattended with liquid effusion, such as have sometimes been called *dry pleurisy*.

"The most decisive signs are those afforded after liquid effusion has commenced. A diminution of the healthy resonance on percussion may very soon be perceived by a comparison of the opposite sides, and the dullness goes on increasing with the increase of the effusion, until at length it often amounts to perfect flatness. At first, it is observed in the most dependant parts of the chest, and rises higher and higher with the advance of the disease. It usually varies with the position of the patient, fol-

lowing, of course, the position of the liquid which necessarily gravitates to the most dependent part, while the lung, which is lighter, has a tendency to float above it. The only exceptions to this rule, are cases in which the lung, and, consequently, the liquid, are confined by adhesions, and those in which the whole cavity is filled with the effusion. In the latter case flatness is universal over the affected side of the chest. Sometimes, when a small portion of the lung is in contact with the walls of the chest, while all the rest is separated from them by effusion, a tympanitic sound is yielded on percussion, which might be mistaken as the sign of pneumothorax or of a pulmonary cavity.

"The respiratory murmur, somewhat enfeebled by the defective movement of the lung from pain, is still more so when liquid effusion takes place, and goes on diminishing with the increase of effusion, and of the consequent compression of the lung, until it entirely ceases in those cases in which the liquid is abundant. In parts in which the lung is still in contact with the chest, the healthy murmur is often superseded by bronchial respiration, dependent upon the compression of the air-cells, which thus more readily convey the vibrations of the bronchi to the surface. This sound is usually greatest near the root of the lung, and diminishes as we recede from that part, though it often extends more or less over the whole side of the chest. But, when the effusion is very abundant, this sound alone is quite lost, except in the region between the scapulæ, and sometimes even there. On the opposite side of the chest, the respiration is louder than is usual in health, and often becomes *puerile.*

"The vocal resonance, increased at first while the exudation is plastic, becomes, at a somewhat more advanced stage of the disease, quite peculiar. When a moderate effusion has taken place, and a thin stratum of liquid intervenes between the lung and side of the chest, the tremulous, quivering, or bleating sound of the voice denominated egophony is heard. The bronchial sound, conveyed outward by the compressed parenchyma, is modified as it passes through the trembling liquid, and acquires the striking character alluded to, before it reaches the ear. This modified sound is heard, especially between the third and sixth ribs, in the

interscapular regions, and between the scapulæ and mammæ. It is most obvious in women and children, in consequence of the higher tone of their voice. Over the larger bronchi, near the spine, for example, it is often mingled with the bronchial resonance, and the sound acquires a peculiar complex character. As the effusion increases, egophony diminishes, and at length ceases altogether. Dr. Williams is of opinion, that little sound of the voice is transmitted when the stratum of intervening liquid exceeds an inch in thickness, except over the larger tubes. When the quantity of liquid is very great, no vocal resonance is heard, except in a narrow space upon the side of the spine.

"These results are of course modified, when the lung adheres more or less extensively to the sides of the chest. In such cases, the bronchial resonance is usually loud and distinct at the adhering parts in consequence of the compression of the air-cells. When the extent of adhesion is small, the compressed lung forms a column, or kind of internal stethoscope, for conveying the sound to the ear. The vibratory movements of the walls of the chest are affected similarly with the sound of the voice, being somewhat increased so long as the effusion is plastic, gradually diminished with the increase of liquid, and entirely suppressed where the intervening effusion is copious, but still distinctly observable where the lung adheres. Hence, when one hand is placed upon the sound side, and the other upon the diseased one, and the patient is told to speak, little or no movement is felt in the latter, with the exception just mentioned, while in the former the thrill is distinct.

"Besides the above signs, there are others derived from the movements and shape of the chest, and the relative positions of neighboring organs. Thus, the affected side may be observed to be quiescent, while the other moves in respiration. When effusion is great, the chest may be visibly distended, and, if measured by a tape, in the direction of a line around the body at the *scrobiculus cordis*, it will be found to be larger on the diseased than on the sound side. This, however, is not common, to any great extent, in acute pleurisy. Any difference that may exist will be most readily detected by making the measurement at the moment of full expiration, as it is then greatest in consequence

of the non-contraction of the distended side. But the fact must always be taken into account, that the right side in health ordinarily measures from a quarter to a half an inch more than the left. The displacement of the heart, liver, etc., is much more frequently to be observed in the chronic than in the acute form of the disease.

"The *course* of acute or sthenic pleuritis is very variable and uncertain. There is reason to believe that, if the disease is vigorously treated at the beginning, it may often be arrested almost at the threshold, before it has exhibited any other signs of its existence than pain, decubitus on the sound side, a little cough, and a chill followed by fever. Exudation not having yet taken place, the physical signs are wanting. Should a catarrhal cough have preceded the attack, or should no cough exist, as sometimes happens, there are no means by which the disease could be certainly distinguished from febrile pleurodynia, which has the general symptoms above mentioned, and the same diminution of the respiratory murmur, arising from the restrained movements of the chest. Hence, the doubt, in these cases, whether it was pleurisy or rheumatism of the intercostals, that was cured.

"In other cases, along with the general symptoms mentioned, there is the friction sound upon auscultation, which is sufficiently decisive as to the nature of the complaint. The effusion of coagulable lymph has probably taken place, and a longer period is necessary for the cure. Sometimes, however, the morbid phenomena wholly disappear in from three to five days, leaving no unhealthy sound in the chest. In such cases, the opposite surfaces of the pleura have united, and the friction sound ceases, because the surfaces do not move on each other.

"In a third class of cases, the signs of liquid effusion are perceived sometimes on the first day; sometimes not until the second, third, or even fourth day, when the severe pain abates. In these cases, the friction sound, if observed at all, is soon followed by feebleness and gradual cessation of the respiratory murmur, by bronchial respiration, egophony, and dullness or percussion. Should the progress of the disease be now arrested, the general symptoms abate, and the morbid sounds gradually give way to the healthy, as the fluid producing them is absorbed.

The friction sound is sometimes heard for a brief period after absorption has taken place, and before union between the opposite surfaces has been effected. The disease is usually cured in five or seven days.

"But, instead of the favorable turn at the period above alluded to, there is often a continued advance of the disease; the effusion goes on increasing; egophony ceases; the bronchial respiration becomes more and more distant, until this also ceases, or is but faintly heard; flatness upon percussion prevails to a greater or less extent over the chest, generally varying with the position of the patient; the dimensions of the affected side of the chest are sometimes even visibly enlarged; and the healthy vibratory movement of its walls in speaking is much lessened or quite wanting, as may be ascertained by applying the hand to the surface. The pain has nearly ceased, and the fever moderated, but the dyspnœa is often great, and the patient is unable to lie upon the sound side. The disease, in this form, continues for a variable period. Sometimes recovery takes place in two or three weeks, sometimes not for months; and the complaint not unfrequently assumes the chronic form. Should it terminate favorably, the fever, cough, and dyspnœa gradually disappear, the dullness on percussion diminishes, egophony occasionally returns in the progress of the absorption, the respiratory murmur is again heard, the friction sound may be noticed for two or three days or more, and health is at length re-established. The clearness on percussion, and the healthy respiratory sound, return usually first in the upper part of the chest and afterward in the lower.

"As the lung has not been sufficiently long compressed to have lost its expansibility, it is generally dilated as the fluid is absorbed; but sometimes, either from its own altered state, or because bound down by false membrane, it does not completely resume its original dimensions, and a degree of contraction in the diseased side of the chest ensues, which, however, generally diminishes, or disappears with time. The favorable termination is often attended or preceded by certain critical affections, as urinary sediment, copious perspiration, diarrhœa, eruptive affections of the lips and skin, plegmonous tumors, and rheumatic pains. After convalescence, the patient not unfrequently complains of a stitch in the

side upon taking a long breath; and sometimes a degree of cough, dyspnœa, and frequency of pulse remains for a considerable time.

"When acute pleurisy is about to terminate fatally, which very seldom happens in the uncomplicated disease if well treated, the effusion increases, the breathing becomes very greatly oppressed, the countenance assumes a pale hue and anxious expression, the pulse increases in frequency, and at length becomes small and feeble, and the heart ceases to beat, in consequence of the imperfect performance of the respiratory function. In the advanced stages, death sometimes results from a gradual failure of the powers of the system, caused by the irritation of the diseased structure. In double pleurisy, according to Andral, a fatal issue may take place from the mere influence of the inflamed membrane, without any discoverable amount of fluid secretions." [Wood's Practice of Medicine.]

The most common terminations of this form of pleurisy are, 1st by resolution; 2nd, by passing into a chronic state; and 3d, by fatal asphyxia. Resolution may be complete, the effused fluid and false membranes being absorbed, cellular adhesions being the only traces left of the disease, or it may be incomplete. In the latter case, the fluid is absorbed, but the false membranes remain, and are subject to various pathological changes.

The second of these terminations will be considered under the head of *Chronic Pleurisy*. Death by asphyxia occurs only in the most severe cases, and is the result of great and sudden effusion. This termination is more frequent in pleurisy than in pneumonia. It is very rare, in the acute stage, and in those cases not complicated with other diseases. It more often occurs in the chronic form of the disease.

Prognosis.—In primary sthenic pleuritis, affecting only one lung, there is seldom much danger, if treated in the early stages with proper remedies. After copiouseffusion the cure, of course, is liable to become protracted, but is generally effected, in uncomplicated cases, without much difficulty. In short, the mortality from this disease, when not associated with others, is comparatively small. According to the report of the City Inspector of New York, the whole number of deaths from pleuritis during three suc-

cessive years, was only one hundred and six, while during the same period of time, the deaths from pneumonitis, were two thousand five hundred and fifty-eight.

Treatment.—In laying down the treatment of particular diseases, I will endeavor to recommend the pursuit of that course, which to me and to my medical brethren, seems most necessary and effectual. My object will be to adapt the treatment to the different stages of disease and to its various forms whether sthenic or asthenic; changing the remedies according to the pathological changes of the organs affected.

In the inflammatory stage of sthenic pleuritis, when the pain in the side is severe, the skin dry and hot, the pulse *full* and *tense*, a decided impression should speedily be made upon the circulation of the blood. To accomplish this, and to relax the muscular system and to favor cutaneous secretion, the vapor bath, is an efficient means of cure. It should be continued until a degree of prostration bordering on syncope is produced.

When the bath cannot be used, sinapisms, stimulating liniments, warm fomentations should be substituted. And, in cases where the bath is applied, the latter means should also be used as valuable accessory treatment.

The contact of air,—a thing always to be avoided in pleurisy,—is prevented by these external applications. For the same purpose, and to supersede entirely the use of other external means, there is used in Bellevue Hospital, New York, a jacket or waistcoat of oiled silk. This, when it can be applied, has many advantages, over other applications. It is less troublesome to the patient, more neat, and permits a change of position, without besmearing or wetting the bed clothes.

The internal remedy upon which the most reliance should be placed, is lobelia. I prefer the extract. Ordinarily this should at first be given in small and increasing doses, in order that the relaxing and sedative effect may precede the production of free emesis. Cases may occur in the treatment of which the remedy should be administered in common emetic doses. My manner of giving it, is to administer an extract pill, containing from gr. ii, to gr. v, once in half an hour, and to continue so to do,

until perspiration, relaxation and free emesis are the result. The degree to which the remedy should be carried in its application, must depend upon the violence of the disease, and the difficulty of obtaining relief.

The pain may be removed, in part, at least, by applying tight around the thorax, a bandage. The object of this is to stop the friction of the lung on the parietes of the chest, and to throw the labor of respiration mostly upon the abdominal muscles. After the stomach has been thoroughly evacuated, the patient should have an interval of *rest*, and should take freely of gum acacia water in order to sustain the system.

After the stomach has become quiet, in case a cathartic is indicated, one should be administered. The following in most cases is as serviceable as any. The proportions of the articles in the formula should be varied according to the exigencies of the case :—

℞	Leptandriæ*	gr. v.,
	Or leptandriæ virginicæ	ʒ i.,
	Podophylliæ	gr. i. ad gr. ii.
	Misce.	

To be taken in sirup or molasses.

* In using the termination *æ* of the genitive singular of Latin nouns in the first declension, I pursue what seems to me the most reasonable course. Nearly all the names of concentrated remedies terminate in *ine* or *in*. If they be considered as Latin nouns of the third declension, terminating in the nominative singular in *ine*, then, like sedile, their genitive must end in *is*. For example *podophylline* (nominative), *podophyllinis* (genitive). Against this method of termination, though, so far as I can see perfectly proper, these objections may be brought :—In the first place it makes the words longer :—In the second place, it does not conform to the termination of other names of medicines. Thus, from quinine, we have quinia in the nominative, and consequently *quiniæ* in the genitive, the termination of which case is the proper one to be used in writing Latin recipes. The same may be said of morphine and strychnine. In these examples the last *n*, with the last vowel, is elided, and the letter *a* forming the correct termination of Latin nouns of the first declension, is substituted for the last *n* in these words. What objection, then, can there be to the adoption of the same rule in forming terminations to the concentrated remedies? I can see none, except it be this;—that in three words, leptandria, sanguinaria, lobelia, meaning, these articles in a crude state, these are the same terminations, as would be found appended to the names of those articles in a concentrated state, in case the above rule were adopted. Thus, leptandrine, dropping the termination *ne*, and adding *a* becomes leptandria, the name of the crude article. This, I believe, is the only reason which at first might seem to militate, against the

After the operation of the cathartic, in order to produce diaphoresis, and lessen the inflammation, administer once in four hours, a pill containing of the extract of lobelia, from gr. i. to gr. iv. alternately with the following powder :—

℞	Asclepiæ	gr. xv.,
	Or asclepiadis tuberosæ	℈ ii.,
	Pulveris camphoræ	gr. xii.,
	Pulveris opii	gr. iii.,
	Pulveris ipecacuanhæ	gr. vi.,
	Potassæ sulphatis	℈ j.
	Misce.	

Dose—from gr. v. to gr. x. once in four hours alternately with the pills.

If the above treatment, after twenty-four or forty-eight hours, fails to give relief—which it will seldom fail to do—inflammatory symptoms still continuing, the whole chest should be fomented with flannels, wet in water so hot as to almost blister the surface. This is usually very effectual in removing the pain. The extremities may with a good effect, be bathed in some cooling liquids, either water alone, or weak ley water, or alcohol and water.

Some prefer cold water applied directly to the affected side. Whether or not this is better than warm water, or fomentations, is not as yet fully decided. To me it seems too dangerous an application to be left to the discretion of a nurse. In the purely sthenic variety of the disease, its effect is probably best—But in asthenic cases, it would be liable to produce a permanent chill, and thus become a source of new difficulty in the cure of the patient.

adoption of the above rule. A little consideration, however, will remove this objection.

Whenever the crude article is meant, in writing the Latin formulæ, by appending to the generic terms, the specific names of those three articles, a clear distinction can be made between the crude and concentrated remedies. No such difficulty, in the great majority of cases, occurs. Out of twenty-six articles, there are only three in which there is any need, in order to perspicuity, of using the specific name.

I shall, therefore, in all formulæ, in this work, adopt the above rule; and, in order that there may be symmetry and uniformity in the nomenclature of concentrated remedies, I would recommend others, in case the above suggestions shall seem proper and useful, "To go and do likewise."

In case these means do not have the desired effect, as a "dernier resort" an enema of lobelia retained until emesis is produced, and relaxation is complete, will, in persons of strong constitutions, and of plethoric habit, be the most effectual means of subduing the inflammation. "The application to the side," says Dr. J. A. Andrews, "of a poultice composed of equal parts of podophyllum and ictodes fœtida will in most cases produce sufficient counter irritation to effect the desired object."

When copious effusion is evinced by the physical signs, and the object is to excite the action of the absorbents, a blister produced by an adhesive plaster, sprinkled over with podophyllin, will be useful. By high authority, which to be sure is not always to be obeyed, unless that authority be clad in the garb of reason and science, the common mode of vesicating in the stage when effusion is copious, is highly recommended. Concerning the propriety of this, the scientific practitioner should exercise his judgment, rather than yield to the bias of preconceived opinions.

The above course of treatment is the one most frequently adopted in the inflammatory stages by eclectic practitioners. Different physicians have different methods of applying remedies. Dr. J. A. Andrews—who, during nearly twenty years of practice has had almost universal success in the cure of this disease—pursues the following course of medication. At first he administers an emetic compounded after this formula:—

℞	Asclepiadis	ʒ ii.,
	Lobeliæ inflatæ	ʒ vi.,
	Capsici	℈ i.
	Misce.	

Dose,—gr. xxx., once in fifteen minutes, until free emesis ensues.

After the effect of the emetic has subsided, he then administers, once in three hours, a powder of the following compound:—

℞	Asclepiadis	ʒ v.,
	Lobeliæ inflatæ	ʒ ii.,
	Ictodis fœtidæ	ʒ i.,
	Capsici	℈ i.

To be administered in infusion, and in doses sufficiently large to produce diaphoresis and relaxation.

In case an expectorant is needed, he uses the following:—

Senegæ pulveris	gr. x.,
Lobeliæ inflatæ pulveris	gr. v.,
Corallorhizæ odontorhizæ pulveris	gr. v.
Misce.	

This should be administered as often as its effects are desirable. On the third day he usually prescribes a mild cathartic, moving the bowels, if necessary, before that day by enemas.

Whenever the common nervines, such as cypripedium, scutellaria, fail to produce the necessary repose of the patient, he prescribes as a "dernier resort" an opiate:—

℞	Asclepiæ	ʒ i.,
	Potassæ bitartratis	ʒ i.,
	Opii	ʒ ss.,
	Ari triphylli	ʒ i.
	Misce.	

Dose,—from gr. v. to gr. vii., as occasion requires.

All of these anti-inflammatory means should be repeated as the case demands.

In the second stage of simple sthenic pleuritis, or that of effusion, diuretics are often of great value. In case the quantity of effused fluid is great and the patient sufficiently strong, hydragogue cathartics, are also effectual means of exciting absorption. The articles most useful for this purpose are podophyllin, jalap, and cream of tartar.

When catarrhal symptoms coexist with those of pleurisy, senega is useful. Diuretics are also valuable to fulfil similar indications. Among the best are galium aperine, eupatorium purpureum, aralia hispida, the seed of arctium lappa. These latter remedies are much more safe than others. Of the aralia hispida, Dr. H. Jacobs, an experienced and successful practitioner, makes frequent use for the purpose of producing the absorption of serous effusion.

In the treatment of pleuritis, reference must always be had to the state of the system, and when this is asthenic the relaxing

and sedative means must be employed with more caution. In bilious pleuritis, cholagogues should be administered early in the disease. If there are typhoid symptoms, or if the disease assumes an intermittent form, quinine should be freely given. When pleuritis is complicated with tubercular disease, care should be taken that the relaxing remedies are not carried too far, lest their effects by producing debility, tend to excite the further deposition of tubercles.

The diet in acute pleuritis should be very low, consisting in the early stages chiefly of mucilaginous or farinaceous liquids. Gum acacia water is almost the only food allowed in the Hospitals in Paris. This, by French physicians, is considered perfectly safe, for diet, and a very useful medicament, even when given in large quantities. Refreshing acidulated drinks may be freely allowed. Lemon juice, added to acacia water, or to an infusion of flax-seed, makes an excellent compound. Sometimes, the addition to the above drink of licorice is useful. The patient should avoid motion and speaking, or coughing as much as possible. The shoulders and chest should be somewhat elevated with pillows. The temperature of the room should be uniform, both day and night. In making any physical exploration, the chest should not be unnecessarily exposed to the contact of air.

"When we find the pleuritis nearly well," says Dr. Gerhard, "but the patient still complaining of some dyspnœa, or a little feverishness, and we discover on examination that a portion of the liquid remains unabsorbed, nothing is so efficacious as a journey, with its necessary consequence, change of air. Although the sea-air is not always adapted to pectoral diseases, it is often of decided advantage in chronic pleuritis, especially if combined with a voyage. This is generally the surest means of dissipating the remains of the disease, and insuring a restoration to entire health. Of course, the usual hygienic precautions as to dress should be attended to."

Section II.

ASTHENIC PLEURITIS.

Pathology.—This form of pleuritis is usually met with in persons who have been debilitated by previous acute or chronic diseases. Most frequently it occurs in the intemperate, or during convalescence from febrile diseases of a typhoid type, from exanthematous and puerperal fevers, from erysipelas; or it arises from organic changes in the kidneys, from phlebitis and diffusive inflammation resulting in the formation of abcesses.

With acute or painful local symptoms, this form of the disease is seldom attended. The disease is, for the most part, latent, effusion often existing long before the disease is detected. Rarely a primary affection, it is most often associated with some other disease, or with some structural change. Its presence is indicated at first, by shortness of respiration, the position of the patient, and the sinking of the powers of life, more than by any severe local distress. The diagnosis, prognosis and treatment of this variety of pleuritis, are so similar to those of the chronic form of the disease, that no separate description is necessary.

Section III.

CHRONIC PLEURITIS.

Pleurisy varies greatly both in severity and in duration. It may be *acute*, in respect to the degree of suffering, and the rapidity of its progress; it may be *latent* in its character and slow in the progress of the successive changes attending and consequent upon it. Between these extremes, the intermediate grades of morbid action are almost innumerable. The term *chronic*, then, in respect to pleuritis, seems to be more of a conventional term, than when applied to most other diseases. In pleuritis the transition of the *acute* to the *chronic* state is so indefinite, and the symptoms of the recent disease sometimes have so little of an acute character, while that of a long duration occasionally mani-

fests so much greater an intensity of irritation, that the terms *acute* and *chronic* would seem to be less applicable to pleuritis than to other diseases. This difficulty arises from the anatomical relations of the pleura. Being a shut sac, its acute inflammation is liable to be made chronic by the retention of inflammatory products. And the chronic is liable to be changed into the acute by the irritation of effused fluids.

But, notwithstanding these difficulties, there seems to be no impropriety in ascribing to the disease, when highly inflammatory and until the inflammatory symptoms seem to arrive at an acme, the term acute. If after that period, lingering fever continues, evidently excited by the products of previous inflammatory action, then the term *chronic* may, with as much propriety, be applied to the disease *after*, as the *acute* to the disease before the acme. In some cases, however, such an acme never seems to exist; and, *to these* the *name sub acute* may with propriety be applied.

Pathology.—The anatomical appearances caused by chronic pleuritis are very similar to those of the acute form of the disease. Of course, the influence of time would tend to produce certain modifications. In general we find the membranes thicker, often composed of several adherent layers, the earliest deposits being harder than those subsequently formed. The character of the liquid, too, is subject to various changes in the onward progress of the disease. It is less limpid, more prone to become turbid with flocculi of a fibrinous character. In some cases it even appears in consistence like jelly. The quantity is greater, and consequently the displacement of adjacent viscera is much more apparent. The lung by continued compression is altered in its appearance, and often becomes wholly destitute of its normal crepitation on pressure. Here and there adhesions are often formed, between which in some cases, little sacs of fluid are enclosed.

Under the best treatment, the disease, when uncomplicated, will generally advance to a favorable termination. But it often is the case, that the morbid products cannot be absorbed, and, consequently, they remain and pass through a series of pathological changes, sometimes ending in gangrene. Cartilaginous laminæ,

bony plates, abscesses, tubercles and hemorrhagic effusions, are among the successive steps in the progress of chronic pleuritis.

"Sometimes," says Dr. Wood, "the walls of the chest are forced inward contrary to their elasticity, so that, when a puncture is made from without, the air rushes in to supply the vacuity produced by their resilience. In some instances secretion goes on as rapidly as absorption, and the liquid accumulation remains for a great length of time. This is especially the case in empyema, or collection of pus in the cavity of the pleura; sometimes the pus makes its way into the substance of the lung, and a fistulous communication is formed between the bronchi and the pleural cavity, through which pus is discharged and air admitted.

"In other instances the liquid takes an external direction, and by means of ulceration escapes into the cellular tissue without the chest, and, traveling occasionally for a considerable distance, produces subcutaneous abscesses in various parts of the chest, which ultimately open, unless life is previously worn out. In thus traveling, the pus has been known to occasion caries of the ribs and vertebræ, sometimes the purulent collection is found to be connected with a tuberculous vomica."

It is sometimes difficult to determine the causes which change ordinary acute pleuritis into the chronic form. Evidently in many cases, too much depletion, the too free use of mercury and other articles making up the antiphlogistic regimen, tend to the production of chronic pleuritis. Often, when a case seems to be cured by such means, the impoverished state of the blood, caused by the use of the lancet, thus rendering the system more liable to be affected by low grades of inflammation, develops a new and unwelcome train of symptoms admonishing the physician that the supposed cure, was after all, delusive.

Dr. Gallup, defining chronic rheumatism, says that it is acute rheumatism half cured. So it may with equal propriety be said, that chronic pleuritis is the acute variety half cured.

Diagnosis.—The general inflammatory symptoms of acute pleuritis may gradually disappear, but, unless the morbid products of the diseased action are removed from the pleural sac, the fever will recur and change its type, now very closely resembling

hectic, now becoming identical with it. This recurring fever is one of the most troublesome and alarming symptoms of chronic pleuritis; for in other respects the patient does not suffer in a manner proportionate to the extent or the duration of the effusion. Dr. Gerhard observes, "I once saw a patient who had performed the full duties of a sailor, going aloft, with an enormous pleuritic effusion. When he returned from sea, it amounted to two or three gallons. This is an exceptional case; but it is very common to find patients who can perform many laborious occupations without much inconvenience. This is generally the case if the dyspnœa is not severe; and we find that some patients complain of little difficulty of breathing with an extent of pectoral disease which will give rise to great distress in other individuals. The symptoms which so frequently characterize chronic organic diseases, are extremely variable in this variety of pleurisy. These are emaciation, loss of the firmness of the muscles, harshness and dryness of the skin, and slight œdema of the legs. Sometimes they are nearly as well marked as in tuberculous disease of the lungs;—in other cases they are very slight; hence, they constitute a diagnostic sign of the disease; and, if we find them well characterized, we will do right to regard the case as one, probably, complicated with tubercles. If our impression be erroneous, we will soon rectify it, as the symptoms will gradually become more decided in the latter case, and slowly disappear if the pleurisy be followed by recovery."

The diagnosis of chronic pleuritis without the aid of the physical signs, is often very difficult. Its general symptoms simulate those of phthisis. But the physical signs are far more reliable. When these are present there is no difficulty in ascertaining the true character of the disease. If it is complicated with tuberculous deposition, the case should be regarded with much anxiety; for the diagnosis then becomes much more obscure, and the prognosis more unfavorable.

Prognosis.—In this variety of pleuritis, when attended with copious effusion, the prognosis is doubtful. The liquid consisting mainly of pus, causes irritation, sometimes so severe as to produce marasmus, and to deprive the system of all that recuperative

power ever necessary in the progress of recovery. Sometimes it proves fatal in consequence of the obstruction to respiration; sometimes by the occurrence of metastatic abscesses in parenchymatous organs. This latter result, however, is not very common.

Treatment.—The treatment of chronic pleuritis differs from that of the sthenic character, less in the kind of remedies used, than in the manner of their application. Whatever means are applied should be such as tend to prevent effusion and promote absorption. For these purposes gentle emetics, followed by the use of vegetable tonics, are very serviceable. Of the utility of occasional emetics of lobelia in chronic pleuritis, there is much evidence. Their operation, in my opinion, is more sure than any other means, to prevent effusion and promote absorption, and to prepare the digestive organs, for the successful administration of tonics. Those who are anæmic seldom bear well the effects of emetics, especially of thorough ones. But those whose digestive organs are inactive, accompanied with febrile excitement, with dry and hot skin, and headache, with derangement in the circulation of the blood, will receive benefit from their occasional use. In connection with them, the vapor bath, or in cases where proper reaction is sure to result, the *pack sheet*, may often successfully be applied.

Counter irritation is useful in this variety of the disease. For this purpose podophyllum or podophyllin sprinkled upon the surface of an adhesive plaster and applied to the side, will, in a short time, produce free suppuration. The same and perhaps a better effect may be derived from the use of Dr. Hill's irritating plaster. Senega and squill may be employed with benefit. To promote absorption, the iodide of potassium has been highly praised. When hectic symptoms appear, they should be combatted with tonics. The infusion or the sirup of wild cherry, I have found more efficacious than many other tonics. I prescribe this, in connection with the sirup of the iodide of iron. One ounce of the latter, added to one pint of the sirup of the former article, makes a good compound.

If there is great debility sulphate of quinine, salicine and hydrastine should, either separately or in combination, be adminis-

tered. To allay cough and produce sleep in those cases attended with much fever, I am accustomed to use, in connection with other nervines, the following preparation:—

℞		
	Extracti lobeliæ	gr. ij ad gr. iv.,
	Morphiæ acetatis	gr. 1-8 ad gr. 1-4.
	Misce.	

Administer at bed time. This usually produces diaphoresis, allays febrile symptoms, and, by promoting expectoration and quieting nervous excitability, relieves the cough.

If there is a tendency to tubercular disease with considerable debility, not attended with much fever, I direct the patient to use for diet, eggs, oysters, beef, with other nutritious and easily digestible articles, and to take as a beverage some pure wine, in quantities not large enough to excite febrile action, and for medicine to take some tonic sirup containing iodine in some of its forms.

In very old pleurisy, tonics are sometimes necessary, especially when the suppuration is abundant. In such cases the chalybeate preparations are recommended by Dr. Gerhard. With these and vegetable tonics, a cutaneous tonic and alterative may with benefit be combined; such as a stimulating bath, especially the sulpur and salt water bath. These are usually taken at their natural sources, by resorting to sulphur springs or to sea bathing. When the artificial baths are used they should be warm. Of cold sea bathing, and the cold sulphur bath for mere debility, after the subsidence of inflammation, Dr. Gerhard says, "that they are seldom appropriate, and that if used at all some caution should be observed in their management."

"In chronic pleurisy" he continues, "it sometimes becomes a question whether the operation of paracentesis should be performed. This is, as is well known, one of the most simple operations in surgery, and no one can meet with the least difficulty in performing it,—but at the same time, it is often very serious in its consequences. There is a rule in surgery which is here strictly applicable; that is, that the exposure of a large suppurating cavity to the air, necessarily excites hectic fever, and sometimes favors the development of secondary abscesses. The chances of

recovery are not, therefore, on the whole increased by the operation, and it is one which we should not perform, unless it be to relieve excessive dyspnœa, which may in itself be severe enough to threaten life."

Concerning the safety and utility of this operation, authors advance different opinions. To prove that many lives have been saved by the spontaneous, or by the artificial discharge of the purulent collection, much evidence can be advanced.

"In my own mind," says Dr. Swett, "there is no doubt that in many cases in which the discharge of pus occurred at a late period, and in which death finally ensued, recovery would have taken place, had the discharge of the purulent secretion taken place at an earlier period in the disease.

"My decided impression is, that in all cases, after proper remedies have been tried in vain, the operation for empyema should be resorted to, and, if possible, before the vital powers are much exhausted. Because, notwithstanding the great and immediate relief experienced from the discharge of the pus, still, a great deal of it remains to tax the powers of life. A more or less copious purulent secretion continues often for a long time.

"There are three classes of cases, in which the question as to the propriety of performing the operation may be discussed. First, there are the cases in which the side is much dilated, the intercostal spaces bulging and fluctuating, and in which pointing even has occurred. These are the cases in which the operation has most generally been performed. Before the discovery of auscultation, these were the only cases in which it could be performed with propriety, for in such cases only could the existence of matter in the pleural sac be ascertained with any degree of certainty. Many cases in which the operation is performed under such circumstances, recover, but death is by no means of rare occurrence. The patient is relieved, often very much relieved at first, but he soon dies of exhaustion.

"Again, there is a class of cases in which the disease, having resisted all treatment, presents a different condition of things. The affected side is not at all dilated, or but slightly so; the intercostal spaces may be a little dilated or not, but there is no fluctuation, and especially no pointing. Shall an operation be ad-

vised in this case? I think so, and that the chances of success will be greater than in the first class of cases. There is one thing that you must endeavor to be certain about—that is, the actual existence of pus in the chest. The history of the case, the progress of the physical signs must be your guide, and your judgment must guard you against a hasty decision.

"Finally, there is another class of cases, in which the effused pus has been absorbed partially, and in which the dilatation of the affected side, if it had existed, has given place to even a partial contraction. Yet the existence of great dullness, and the absence of a respiratory murmur over the lower portion of the lung, the existence of hectic fever, and of other symptoms, must lead to the belief that the pus is still there, and that it refuses to be absorbed. The cause of this cessation of the absorption is probably the compressed state of the lung, which refuses to expand. What shall be done in this case? Open the chest? I confess I have never seen the operation performed under these circumstances, but I have examined fatal cases in which I wished it had been performed.

"Another question presents itself in these cases. What is the condition of the lungs? What is the condition of other organs? It is certainly desirable to know that the lungs were probably healthy before the attack, and that no evidence exists of any subsequent disease. Suppose, after examining the chest, we suspect that an abscess is forming in the lung. Shall this make you hesitate? Shall you wait and see if nature will not open a communication with a bronchus, and thus discharge the pus? We may wait in vain for this result, and even if it should, in time occur, it is a far less agreeable and thorough mode of evacuating the chest than the operation of paracentesis. Suppose we have reason to fear that the patient may be tuberculous, should that deter us? I think not. Would we not open an abscess anywhere else in a tuberculous patient? Would the discharge of pus exhaust him? I think not. It would relieve him, and thus prolong his existence.

"Even in cases in which a softened tubercle has ruptured into the pleural cavity, and a bronchial communication has been, at the same time established, constituting what is called hydro-pneu-

mothorax, should this operation even then be performed? I have never seen the operation performed under these circumstances but once, and then a fatal termination soon ensued. But I have recently met with two cases in this hospital,—the New York Hospital—in both of which the post-mortem examination made me hesitate as to the propriety of the course pursued. In one case, all the signs of hydro-pneumothorax continued until death, yet after death the lungs were found so nearly healthy, the tuberculous deposit was so small, that I could not help thinking, had the operation been performed—this was decided against in consultation—the life of the patient might have been prolonged, and his condition rendered more comfortable.

"Another case occurred, in which the signs of hydro-pneumothorax existed, but after a time the evidences of communication with a bronchus ceased, and this condition continued until death. In this case, also, the lungs were very little diseased, and the opening into the bronchus could not be detected by inflating the lung. It had no doubt been closed, perhaps by being covered by a coating of lymph. In this case, and for a still stronger reason, the bronchial communication having ceased, the operation might have aided materially in prolonging life.

"It is difficult to say what the precise condition of the lung is in such cases. But this we do know, that hydro-pneumothorax occurs most frequently when there are but few tubercles in the lung. A copious deposit of tubercles leads to a secondary pleurisy with effusion of lymph only, by which the cavity of the pleura tends to become obliterated, and the form of the disease I am now considering, is no longer likely to occur." [Swett's Lectures.]

The operation for empyema, or for the evacuation of other liquids besides pus, from the cavity of the chest, is very ancient, being referred to by Hippocrates, B. C. 460, as well as by many others at different subsequent periods of time. Although a full description of this operation belongs more properly to works on surgery, yet following the example of several standard authors, I deem it best to insert its description, as given in Smith's Operative Surgery.

The *diagnostic physical signs*, indicating such a condition as would justify the operation, are enlargement of the side, dullness

on percussion, absence of free respiration, vocal resonance and a projection or fluctuation in the intercostal spaces.

"The operation of paracentesis thoracis" says Dr. Smith, "has been variously performed, but the object of all the plans is to evacuate the liquid contents of the part, without admitting air into the pulmonary cavity. To accomplish this, it has been suggested to puncture the parietes of the chest with a trocar and canula, or with a trocar and syringe, or to make a direct dissection, layer by layer, from the skin to the pleura. In all the plans that have been recommended for the accomplishment of this object, surgeons have differed mainly in regard to the best point for the puncture; but, as the patient is usually compelled to sit up, and as the general anatomical relations of the region especially favor a certain point, it is sufficient to state that, when circumstances admit of it, the space between the fourth and fifth, or fifth and sixth ribs, and a little posterior to their middle should be selected.

In order to avoid wounding the diaphragm, which is presumed to be pushed up by the liver, it is generally advised to puncture the right pleura one rib higher than that advised for the left. Such a position is, however, far from being established as correct, the idea being based rather on the descriptions of the normal condition of the part than on the diseased state, and it is most probable that the weight of the fluid collected within the right pleura will more than counteract any elevation of the liver when the patient is in the erect position. In counting the ribs in a person of moderate flesh, but little difficulty will be found in tracing them from below, upward; but in those who are fat, or in those who have the side œdematous and swollen, it may be impossible to distinguish these spaces, and under such circumstances the rule has been given to select a spot which is about six finger-breadths below the inferior angle of the scapula.*"

"Ordinary Operations of Paracentesis Thoracis.—The patient being propped up in bed, and a little inclined to the sound side, so as to separate the ribs as much as possible on the diseased side, the skin is to be divided to the extent of one and a half

* Malgaigne.

inches in a direction parallel with the superior edge of the lowest rib on the intercostal space, that is selected for the puncture. After dividing the superficial fascia, and any portion of a muscle of the chest that may intervene, as well as the external and internal intercostal muscles, the pleura will be found generally to bulge into the wound. After being distinctly felt by the forefinger, so as to establish the fact that only fluid is behind it, the puncture should be made with the point of a bistoury, and the opening gradually enlarged as the liquid escapes.*

"If the pleura is very much thickened, care will be requisite to avoid the error of pushing it before the instrument. Velpeau entertains the opinion that in cases which require the operation, the effused liquid, or even an abscess, will remove the lung from the point of puncture. He, therefore, objects to the details just given, and advises that the side of the chest be at once opened by a deep puncture with the bistoury in the same manner as an ordinary abscess.

"After Treatment.—If circumstances render it desirable to keep the wound open, a tent may be introduced, and removed from day to day; but if the whole of the liquid be evacuated, the opening may be at once closed with adhesive strips, a compress, and bandage.

"If the subsequent discharge continues copious, or becomes very fetid, advantage may be derived from washing out the cavity with warm water, or warm barley water; weak astringent washes, or those of an anti-septic character, being subsequently employed. In order to evacuate the liquid, and yet prevent the entrance of air, various contrivances have been employed. Pelletan employed a syringe for this purpose, and Reybard placed a piece of gold-beater's skin, or the intestine of the cat, over a canula introduced into the pulmonary cavity, by means of a perforation in the rib, so that the matter might flow out and yet the air not enter.

"Dr. Wyman, of Cambridge, Mass., has invented a brass suction-pump with an exploring canula, in order to permit the evac-

* Velpeau's Op. Surg., by Mott, p. 515, v. iii.

uation of the fluid without allowing the air to enter the pleura, and has reported numerous instances of the success of this mode of operating, which he thinks is preferable to the ordinary mode of incising the soft parts.

"Remarks.—The value of the operation of paracentesis thoracis has been differently estimated at various periods; most of the surgeons, up to the time of Laennec, having regarded it as a doubtful or dangerous operation, especially from the difficulties attendant on the diagnosis. Since the more general resort to auscultation, many of these difficulties have been removed.

"But, though the cases can now be better selected than they were formerly, a successful result is not always obtained. The true results of the operation may, it is thought, be correctly stated thus:—Paracentesis always affords temporary relief, and almost one-half of the cases recover; but whether these patients would have died without it, it is difficult to tell.

"The idea is certainly erroneous that paracentesis thoracis is an eminently successful operation, and though its results have been such as to justify its performance, the prognosis should be guarded. From statistics collected from various sources, it appears that the mortality is considerable, and the objections that have been raised against the operation in former days should be regarded. They are thus stated by Velpeau:—

"If the lung has been forcibly compressed by the liquid, and yet is permeable, the evacuation of the liquid without the entrance of air into the pulmonary cavity may distend it so rapidly as to excite violent inflammation. If, on the contrary, the lung has shrunk so much as to yield but slowly to the entrance of air, the void which is immediately left about the parts, is very liable to derange the respiration and pectoral circulation. The introduction of air into the cavity of the pleura, though obviating this, yet exposes the patient to danger by exciting the inflammation, and creating unhealthy pus, thus giving rise to adynamic symptoms, under which many have died.

"Estimate of the Operation.—In estimating the value of any of these modes of operating, the difficulties or objections

applicable to each should not be overlooked. When the intercostal spaces are prominent, and the presence of liquid certain, the direct puncture of Velpeau is best.

"When there is any doubt of the position of the liquid, then the ordinary operation by dissection of layers would be preferable. Where, however, the diagnosis is positive, and the chances of failure from the accident of pushing forward the thickened membrane, instead of perforating it, is guarded against, the instrument of Dr. Wyman of Massachusetts may prove advantageous. In Boston, the experience of the profession is said to be favorable to it.

"Under all circumstances, the surgeon may anticipate an anxious and long-continued convalescence of the patient, and one which will exact all his skill as a practitioner, to conduct the case to a favorable result.

"The employment of a trocar is the most objectionable of the various instruments employed, as it is not so shaped as to obtain a keen edge, whilst the point of the cannula, even when closely fitted to the shoulder of the instrument, is very liable to tear or push the pleura before it, as is occasionally seen in cases of hydrocele, accompanied with thickening of the tunica vaginalis.

"When the surgeon recalls the constitutional effects liable to result from opening closed cavities, and especially those containing pus, and covered by a pyogenic membrane, he can readily foresee the consequences of opening the pleura in cases of empyema. The natural tendency of such collections is either to be absorbed or discharged by the efforts of nature. If discharged by nature the inflammation of the surrounding parts, and the character of the opening made by ulceration, are well known to be more favorable to a cure than is the case when the surgeon punctures it. I would, therefore, express the opinion that this operation should not be resorted to until the latest possible moment; that, when done, air should be prevented from entering the cavity of the chest; that the pus should be slowly and only partially discharged, the wound closed, and the operation repeated, if necessary. If, however, the entrance of air cannot be prevented, it will be better to evacuate the whole of the liquid, and treat the case subsequently like one of abscess."

From statistics, it appears that nearly two-thirds of the cases operated on have been cured. [Smith's Operative Surgery.]

The result of the operation, though more favorable than some authors represent, should teach the importance of using all possible preventive means, in order to avoid the necessity of its performance. The question, then, very naturally arises, can any means more efficient than those in common use among allopathic physicians, be used to prevent the recurrence of its necessity? I think so. The object, as has been before stated, is to promote absorption, and to sustain the strength of the system while the curative process is going on. Ordinarily physicians depend, for the most part, upon diuretics and tonics; seldom using as curative agents emetics. But notwithstanding this, these when properly used, and composed of such articles as produce temporary debility only, are in my opinion of great service. In acute pleurisy they have had the sanction of Riverius, Ruland, Blegny, Mursinna, Morgagni, Wright, Stoll, Tissot, Ackermann, and Schelhammer. And Dr. Copeland adds that, when discreetly prescribed, they are important aids in the treatment of most of the forms of the disease.

Dr. Gallup observes "that the character of the chronic morbid habit leads us to infer, that certain operations which may bring into exercise the minute circulations, may be useful to restore their integrity of function. One adjuvant has been found in the exercise of vomiting; and we make it a substitute for corporeal exercise for those not in a condition for this. Not only so, but it exercises every minute tissue more effectually than any mere muscular exercise. It is necessary that this, with other processes, should precede, and prepare the system to endure muscular motion with benefit by removing the morbid derangements.

"The lungs as well as all the internal organs, are exercised by emesis, and their functions promoted by it. The exhalents and mucous follicles discharge more freely, and the internal infarctions of the blood vessels are agitated, and absorptions promoted. The centrifugal and exhaling surfaces are excited, not by direct stimulants, which would add to the diseased state, but by a train of associate motions restoring or exciting their lost functions. Even the exercise of nausea is extended very considerably to all

the tissues, and in many conditions may, where there is much lowness, be used as an occasional substitute for emesis. These processes may be so conducted as not to exhaust overmuch. Like corporeal exercise, they may be extended to the point of fatigue but not of exhaustion.

"It is not a single emesis that will be of much use, to remove a fixed state of disease of slow access; but it must be reiterated, and in connection with other auxiliaries. The patient should always be in a warm condition during the process, so as to promote dermoid action, and sometimes moderate sweats."

Emetics, it seems to me, are for another reason, useful in chronic pleuritis. One object is to produce expansion of the compressed lung. While the emesis promotes absorption of the effused fluids, it also, by producing deep inspirations, expands the lung, which, in consequence of its sudden increase in size, excites still more the function of absorption. They, also, when composed of proper articles, and properly administered, prepare the system for the effectual application of tonic remedies. To prescribe this latter class of curative agents, when the mucous membranes are coated with morbid secretions, is worse than useless. I have seen patients laboring under some chronic disease of the pleura, who had been treated with tonics with no benefit, rapidly recover after the administration of an emetic, followed by the use of those very remedies, which they had before been using with no salutary effect.

They should be repeated once a day, or once in two or three days, according to the degree of benefit received from them. A very good time is in the evening about an hour after coming from a warm bath. Some who suffer much in the morning from collections of muco-purulent matter, receive the most benefit by using the emetic at this time.

The intervals between their administration should be sufficiently long to afford rest and refreshment to the patient. Nor should he, in the interval be continually harrassed by other medicines of doubtful utility. A nutritious diet should be used, and all food containing but little nutriment in a large bulk should be avoided.

My manner of administering the emetic in very feeble patients is this:—I give, after the patient is warm in bed, and his stom-

ach is somewhat distended with warm water, at suitable intervals, a pill containing from gr. ii to gr. iv. of extract of lobelia, until considerable nausea is produced. Then I direct the copious drinking of warm water which in a few moments is usually followed by an easy and free evacuation of the contents of the stomach. In other cases, when the patient can bear more heroic treatment, the pursuit of the above course is not necessary, but the emetic may be given in the ordinary way. In case much distress results from the effects of the emetic, administer, in cold water, and repeat the same, acetic, or citric acid.

The means chiefly to be relied upon, in warding off the necessity for an operation, are the vapor bath followed by brisk friction, gentle and repeated emetics, followed by the strongest tonics, and nourishing food, and vegetable diuretics. Inhaling tubes for the purpose of expanding the compressed lung, are by some highly recommended. When the effusion has a purulent character, the hydriodate of potassa in the dose of two or three grains, three times a day is often useful; in more asthenic cases, the iodide of iron, in rather small doses may be given. For a diuretic, when the vegetable diuretics before mentioned, fail to give relief, the tartrate of iron is serviceable, especially where a dropsical diathesis prevails.

Section IV.

LATENT PLEURITIS.

This variety differs from others mainly in the absence of the more common rational symptoms, such as dyspnœa, cough and pain. These are either entirely wanting or are so imperfectly developed as to make it impossible to found upon them an accurate diagnosis. The disease passes so insidiously through its different stages, that the patient is seldom aware of the nature of the malady with which he is affected. After recovery he often forgets the trifling indisposition which he felt during its progress. In this form of pleuritis adhesions of the lungs to the costal pleura often become extensive. In rare cases the general symptoms are more marked, attended with a gradual wasting of the vital forces. In general such cases are complicated with phthisis.

Pathology.—The anatomical lesions in latent pleuritis differ so little from those already described, that their consideration in this place would be but a useless repetition.

Diagnosis.—The absence of the rational symptoms, makes the diagnosis dependent almost wholly upon the physical signs. In case there is considerable effusion, we have dullness on percussion, feeble respiration and egophony.

Additional evidence of the pleuritic character of the disease is afforded by the existence of the *friction sound.* In case this is absent and the other signs above referred to are but imperfectly developed, there is danger of confounding the disease with enlargement of the liver, or with consolidation of the lung. In the majority of cases, however, the physical signs are so well marked that a correct diagnosis may be made. With tuberculous disease it is often so intimately connected that it is difficult to determine how many of the morbid phenomena proceed from the tubercular deposits, and how many from the pleuritic inflammation. Almost always in those of a scrofulous diathesis, these two diseases are more or less mingled together; and hence, in such persons, the slightest symptoms of phthisis occurring in pleuritis should be closely observed.

Prognosis.—The prognosis is favorable or unfavorable according to the nature of its complicating diseases, and the condition of the constitution. When associated with phthisis there is but little reason to hope for recovery; when isolated and occurring in a healthy constitution, it generally, under proper treatment, terminates favorably.

Treatment.—The treatment does not materially differ from that of other chronic forms of the disease. There is, therefore, no need of any repetition in this place, of that which, under the head of Chronic Pleurisy, is fully described. The remedies should, of course, be continued until all physical signs of the disease disappear, and the general healthy appearance of the patient is indicative of complete recovery.

Section V.

SECONDARY AND COMPLICATED PLEURITIS.

Pathology.—Pleuritis is often associated with inflammation of an adjoining tissue or organ, or with some other lesion or malady. It may be either primary or secondary. With inflammation of the parenchyma of the lung it is frequently complicated; the disease sometimes beginning in the pleura and extending to the substance of the lung; at other times, on the contrary, beginning in the lung and extending to the pleura. This complication is usually termed *pleuro-pneumonia*, and by older writers was known by the name *peripneumonia*. In such cases the inflammation usually assumes a *sthenic* character. The pleuritic and the pulmonic inflammation may be coetaneous. More often, however, the pulmonic, is antecedent to the pleuritic than the reverse.

Some writers assert that the complication of pneumonitis with pleuritis lessens instead of increasing the danger. The reason given is derived from the idea that the pneumonia is lessened by the pressure of the effused fluids of pleuritis. The lung also by its increased size, in consequence of the engorgement of its vessels, presses upon the fluids, and this excites a degree of activity in the absorbents, which under other circumstances would not exist. There is, then, according to this theory, a reciprocity of action, whose tendency is to the cure of the disease.

Pleurisy is sometimes complicated with exanthematous and continued fevers. Unless it occurs in the period of convalescence from these maladies, it is prone to assume the sthenic form, but when during recovery the fluids of the body are contaminated, and the vitality of the system depressed, the asthenic form is most common. Whenever, in fevers, the breathing becomes very short and frequent, whether or not accompanied with pain in the side and cough, then pleuritic inflammation may be suspected, and an examination should be immediately made in order to arrive at a correct diagnosis, and predict with certainty the nature of the termination.

Another very frequent complication of pleurisy is with phthisis and chronic tubercular pneumonitis. Tubercles existing near the surface of the lung, often excite inflammation in the circumjacent tissues, which is readily extended to the pleura pulmonalis. On its free surface lymph is effused, which, coming in contact with the pleura costalis, excites on it inflammation. Adhesion usually is the result. Sometimes, however, a different state of things takes place. A cavity, by the softening of tubercular deposits, is formed near the surface of the lung before adhesion is effected. This, in some cases, producing a perforation of the pleura pulmonalis, and at the same time communicating with the bronchial tubes, admits into the cavity of the pleural sac, the atmosphere. This kind of lesion is called pneumothorax, which, in another place, will be more fully considered.

Tuberculous pleurisy may be consecutive to tubercular deposits in the parenchyma of the lungs, and then it is strictly secondary. Again, in the second place, it may arise from the deposit of tubercles in the pleura itself; and, lastly, the inflammation of the pleura is antecedent to the tubercular deposit, the pleuritis thus becoming an exciting cause of phthisis. The latter effect of pleuritic inflammation should then be considered in this connection. Why is pleuritis more prone to produce tubercular disease, than pneumonitis? To answer this may be difficult; and yet such is the fact. May not the absorption of pus into the blood be one prominent cause? This, like all other impure matter in the blood, must tend to produce more or less debility, must excite an irritative fever simulating the hectic of phthisis.

That febrile action which most nearly resembles the hectic of phthisis, should cæteris paribus be most likely to afford conditions most favorable to the development of tubercles. This may be one cause of the tendency of pleuritis to generate phthisis.

Pleuritis is also complicated with many other diseases, with pericarditis, hepatitis, peritonitis, and rheumatism. These complications, however, are not sufficiently common to be made subjects of separate consideration.

Diagnosis.—The diagnosis in complicated pleuritis, must depend upon that accurate discrimination in the balance of symp-

toms, which is the possession of every close observer of disease. Each symptom is often a complex phenomenon, divisible into a number of separate signs. If in the course of pneumonitis, the friction sound occurs, if there is great dullness on percussion, the limits of which change on every change of posture, if there is egophony, if either one or all of these physical signs, are combined with those of pneumonitis, the diagnosis will be evident. Complications with phthisis will of course, give the signs of both diseases; with pericarditis, will give the friction sound of pleuritis heard only during respiration; while the friction sound of pericarditis is heard during the *suspension* of respiration. The effusion, and consequent dullness of pericarditis is confined to a small space—the præcordia; that of pleuritis extends over the base and sides of the lung and is in general changed by any change of posture. When both these trains of symptoms are coetaneous, the nature of the complication will be evident. The diagnosis of other complications must depend upon principles similar to those already suggested.

The Prognosis will depend upon three conditions, the nature of the complicating disease, the extent of the pleuritis and the constitutional state of the patient. Pleuro-pneumonitis, has already been referred to. Pleuritis complicated with phthisis is always very dangerous; with pericarditis it is unfavorable.

Treatment.—The complications of pleuritis necessarily involve the same principles of treatment as the more distinct forms of the disease. Regard must be had to the nature of the malady with which the pleuritis is associated. If its complication be with some other sthenic inflammatory disease, the anti-inflammatory means must be used in the process of cure. If associated with pneumonitis, all narcotics should be used with more caution than in its simple form. When arising from the retrocession of eruptions from the surface, warm bathing with stimulants and diaphoretics should be used. When complicated with phthisis, the treatment for the latter disease is most appropriate.

Section VI.

PLEURITIS OF CHILDREN.

Pleurisy is common in children of all ages; but is most frequent in its uncomplicated forms after the age of five years. Anterior to that period it is, in general, associated with pneumonitis and bronchitis. Sometimes it is a sequela of eruptive fevers. During the whole period of convalescence from them, while the functions of the skin are but partially restored, this disease in children is prone to occur.

Pathology.—Primitive pleurisy in young children does not present any striking anatomical characteristics which distinguish it from the disease in adults, as in the case of pneumonitis. There is, however, one fact in those cases, which points out the affection. It is a want of compressibility in the lung from the liquid effusion. The effect of this is seen in the modification of the physical signs which it produces.

Diagnosis.—Dullness on percussion presents its usual characteristics. But the respiratory murmur, on the contrary, instead of being feeble or absent, assumes a *bronchial character*, equally as distinct as that of pneumonitis, but far more extensive, accompanying the dullness on percussion, and being often heard all over the affected side, and without crepitation or rhonchus. "This *bronchial respiration*," says Dr. Swett, "as connected with pleuritis, is the rule, in the pleurisy of young children, not the exception, as in that of adults."

Prognosis.—Pleuritis in children is far more dangerous than in adults; more especially when it occurs as the sequela of eruptive fevers, of pneumonitis, or pertussis. In infants this disease, whether simple or complicated with pneumonitis, bronchitis or whooping-cough, is often fatal. In twenty-four hours, by causing suffocation, it may end in death. In very young children it seldom assumes a chronic form; for in them the later stages of the disease are less liable to occur.

Treatment.—Pleurisy in children requires the same measures which are recommended for adults, modified according to age and to the susceptibility of infancy to the influence of remedies. Relaxing enema should be more frequently directed, and the use of the more harsh and debilitating means, more cautiously prescribed. Warm demulcent poultices, instead of irritants or vesicants, should be employed. In the chronic form, the frequent sponging of the surface with warm salt water, as an external application, is excellent. For an internal remedy, the sirup of the iodide of iron, administered in simple sirup of sugar, is sometimes serviceable as a tonic.

Other varieties and modifications of pleurisy are described by some authors. But they are for the most part, unimportant, and their consideration is of no practical utility.

CHAPTER XII.

PNEUMOTHORAX.

The term pneumothorax from the Greek πνευμα air and θωραξ chest, which would, according to its etymology, mean any collection of air in the chest, is at present, used to designate more especially the effusion of aeriform fluids in the cavity of the pleura, whether the air exists alone, or whether there is sometimes a certain quantity of liquid mingled with it. In the first instance the collection receives the name of pneumothorax, in the latter that of hydro-pneumothorax. Notwithstanding the distinctive use of these terms, the name pneumothorax is in general applied to both of these phenomena.

Before the commencement of the present century, it had not been made a subject of thorough investigation. To Laennec belongs the honor of first making it an object of scientific study.

Pathology.—Pneumothorax is a consequence of lesions of both the lungs and pleura. In most cases it is the result of tubercular disease perforating the pleura pulmonalis, before it adheres to the pleura costalis. The cavity formed by tubercles communicating

with the pleural sac, and at the same time with the bronchial tubes, gives rise to this affection. Sometimes pneumothorax occurs in gangrene of the lungs. A gangrenous eschar may break into the pleural sac, and a communication be formed with the bronchi. It is possible for an emphysematous vesicle in the lung to rupture the pleura covering it, and thus produce a pneumothorax.

Another way by which this has been supposed to be produced, is the secretion of air by the absorbing surfaces of the pleura, or by the decomposition of inflammatory products. A fistulous opening or wounds produced by accident or by the hand of the surgeon sometimes are its immediate cause.

When the air enters the cavity, it compresses the lung and gives rise to the physical signs of this organic lesion. Perforations of the pleura, as we should expect from the more frequent location of tubercles in the left lung, oftener are found on the left than on the right side. Reynaud found in forty cases of perforation, twenty-seven on the left lung, and thirteen on the right.

Diagnosis.—*General symptoms.* These are very equivocal, and altogether insufficient to serve as the basis of a confident diagnosis. Dyspnœa caused by the compression of the lung is a very constant symptom. Its degree depends upon the amount of air and liquid in the cavity of the pleura, upon the rapidity and permanence of the accumulation, and upon the condition of the opposite lung. Cæteris paribus the dyspnœa will be less, when the admission of air or the collection of other fluids, is gradual; because the organs of respiration and circulation, to a certain extent, accommodate themselves to the new condition.

Most frequently it happens that the entrance of the air is sudden, and as a consequence, dyspnœa quickly becomes severe attended with acute pain, and sometimes with a sensation as if something had given way in the chest. In case the pleural sac is distended with pus, a copious expectoration of a puriform character suddenly supervenes as a result of the opening into the pleura.

Sometimes it so happens that the pleural opening is so large as to permit a ready egress of the air admitted into the pleura, in which case the dyspnœa will be less violent. On the contrary, if

the opening be such as to permit the passage of air only one way, like the valve of a pump, then at every inspiration more air is admitted than is expired, until the accumulation is so great as to cause suffocation. Very soon, under such circumstances, death may occur, preceded by the most painful and laborious breathing, intense anxiety and general prostration. When one lung from the effects of the disease is unfitted alone to arterialize sufficient blood to sustain life, and the pneumothorax occurs on the other side, sudden death is almost inevitable.

When communication first takes place between the lung and pleural cavity, there is not only dyspnœa, but also sharp pain and cough, in consequence of the irritation of the pleura. This is sometimes very severe; so much so as to cause a great depression of the vital powers. This, however, is usually followed by reaction, giving rise to the ordinary symptoms of fever. The cause of this irritation, by many, has been supposed to arise directly from the contact of air with the serous membrane, the pleura. Concerning this, there is, however, some doubt. A probability exists, that the acid matter from vomicæ, drawn into the pleural sac with the air, produces much of the effect usually ascribed to another cause. In case liquid exists in the pleura, anterior to the ingress of air, its admission would be very apt to produce chemical changes in the effused substances, and thus secondarily cause irritation. In general, the sitting posture is most agreeable to the patient, or if he lies down, the decubitus, after the pleuritic pain has subsided, is on the affected side.

Special symptoms. Without some more sure means of detecting the existence of pneumothorax than the general symptoms, a correct diagnosis could not without great difficulty, if at all, be determined. Of all the diseases affecting the chest, this, though once so obscure, has now become by the aid of the physical signs, the most easily detected. As soon as the air enters the pleural sac, the lung collapses, and consequently less air is inspired. The effect of this, is to lessen the respiratory murmur on the affected side.

Under such circumstances, what does percussion reveal? The pleura distended with gas, and the lung collapsed, afford conditions which, from reason we should expect to favor the production

of great resonance. And thus we find it to be. On the diseased side, we get the drum-like sound on striking the chest, while on the opposite side we have more flatness on percussion, but a louder respiratory murmur. So that the physical signs on the two lungs, are opposite. On the diseased side there is great resonance, but very feeble if any respiratory murmur. On the healthy lung, the resonance is less than on the other, but the respiratory murmur is more distinct than natural. As the disease advances, and pus collects, or if there is at first water in the pleura with the air, the percussion detects the exact extent of the liquid collection, it draws the line of demarkation between the water and the air. Whenever the patient changes his position, the location of the flatness is likewise changed, and the metallic tinkling is heard when the patient, after lying in one position, suddenly changes it; so that the liquid adherent to the sides of the pleura falls in drops upon the surface of the liquid below. The production of this sound, however, is a matter concerning which there is not among physicians a full agreement. There are according to some two methods by which it is produced; the first by the falling of the liquid drops as above described, the second, by the passage of air, which, entering the liquid in the pleural sac beneath its surface, causes, as it perforates the surface of the liquid, little bubbles to rise, that burst and produce the sound. This bursting of bubbles, makes a sound, which, on being reflected from one side of the cavity to the other, comes to the ear so modified, as to produce that peculiar tinkle, which authors describe.

Sometimes this occurs when there is no liquid in the pleural sac. In this case how can it be produced? Mr. Castelnau's views will explain the phenomenon. The metallic tinkling, according to his theory, may be caused by the bursting of air-bubbles in the tuberculous abscess itself, just at or near the point of perforation, and the sound thus generated resounding in the large air-chamber formed in the pleural sac, changes a rattle which would otherwise be a mucous rale, into metallic tinkling. The metallic tinkling is by no means a constant sign, therefore it should be considered as of less importance than amphoric respiration, and resonance of the voice.

To detect the presence of liquid in the pleural sac, the Hippo-

cratic method of succussion is useful. The mode of procedure is simple. The patient is placed in a sitting posture, and while the body is quickly though moderately shaken by applying the hands upon his shoulders, the agitation of the fluid thus produced, is very clearly heard.

Another morbid sound heard in this disease, is the amphoric respiration, that buzzing sound caused on blowing into a bottle. The cavity of the pleura may be compared to the bottle, and the perforation of the pleura, to the opening into it. As soon as the pleural sac becomes somewhat distended with pus, the amphoric respiration ceases, or if the opening is covered with false membrane, so as to prevent the exit of air from the cavity, after having entered it in inspiration, the amphoric sound is not heard, and there is either no morbid sound, or a slight bronchial respiration.

Attendant upon the amphoric respiration is a corresponding resonance of the voice, which follows the same course and ceases at the same time.

As pneumothorax passes into empyema, the physical signs decline, and there is then dullness on percussion, with almost entire absence of the respiratory murmur. The accumulation of pus is then much greater than in ordinary cases of pleurisy, sometimes amounting to several gallons, causing extreme difficulty of breathing.

By the general symptoms of pneumothorax, certainty cannot be obtained in diagnosis. With the physical signs, however, there is no difficulty in detecting the nature of the lesion. These are not only pathognomonic of the existence of the disease under consideration, but they go farther, and enable us to point out its different stages, its degrees of severity, and its gradual passage into empyema.

Prognosis.—The prognosis is generally unfavorable. In general, it is speedily fatal. But this result depends as much upon the disease which causes the pneumothorax, as upon the degree of the existing lesion. In case one lung is affected by tubercular disease, or in any way prevented from performing its functions, and the healthy lung is so perforated as to produce on that side, pneumothorax, the effect is necessarily fatal. In such a case the

patient dies in a few hours or days, from exhaustion and orthopnœa.

In forming the prognosis, therefore, the condition of the lung, not the seat of perforation, should be made an object of special study. If one lung is healthy it may carry on the functions of both. Whenever, then, we have one healthy lung and the other is not the location of tuberculous disease, the prognosis is more favorable. But if the diseased lung is tuberculous, although the other is comparatively healthy, the probability of recovery is small, for the phthisical disease soon extends to the healthy lung, and destroys it. If the pleura is completely filled with pus, the effect is to develop hectic fever, and therefore the physical condition is worse than when the pleural sac is filled with air alone. Under the most favorable circumstances, we should consider the prognosis uncertain, and in those cases complicated with phthisis, there is no hope of a cure.

Pneumothorax has no fixed period of duration. In a short time it may prove fatal. Dr. Gerhard relates one case in which death took place in less than an hour, and two other cases in which life was prolonged until the lapse of fifteen or eighteen months. In one of these latter cases, the patient made two long voyages, and, according to his own statement, did full duty as a seaman while his pleura was enormously distended with pus.

Treatment.—The means which art is able to employ in the cure of this disease, are limited. There are, however, certain general indications to fulfill, a knowledge of which is serviceable to the practitioner. If the pain is severe and if dependent upon a perforation of the pleura with inflammation of that membrane, local means, such as warm fomentations, or sinapisms applied over the painful region may be employed with advantage. The degree to which general relaxants should be carried must be proportionate to the intensity of the symptoms. Some preparation of lobelia, or the employment of some other diaphoretic and sedative agent administered according to the necessities of the case, will be useful to allay inflammation.

Cough preparations sometimes are useful. In cases in which there is but little hope of permanent relief from medicine, and in

which other nervines are not found sufficiently potent to allay pain, opiates should be given to quiet the system, and procure sleep. If pneumothorax caused by a wound, should suddenly arise in a strong and vigorous constitution, the most active relaxants in the materia medica should be immediately employed in order to keep down the inflammation.

To prevent febrile excitement, and to promote absorption of effused liquids, those means should be used which, in the article on Chronic Pleuritis, are recommended. To sustain the strength, the most efficient tonics and nutritive diet, should also be used. In case these do not have any good effect in consequence of the disease of the digestive functions, gentle emetics should be occasionally prescribed.

If remedies fail to prove at all salutary, and the disease should threaten immediate suffocation from the quantity of air and liquids in the pleural sac, the gas and liquid should be evacuated by the operation for empyema. Experience proves, that, under certain circumstances, the opening of the chest may be made with a good effect. Successful cases are reported by Laennec, by Riolan and Ponteau. In case the opening is made without the admission of air, the disease under favorable circumstances admits of cure.

[The operation, according to Dr. Gerhard, is allowable when the object is to favor the escape of gas, or the pus which is afterwards secreted. Immediately after the perforation of the pleura, the dyspnœa may suddenly become so great that immediate death is to be feared. The side may be punctured in the usual manner, and the gas be allowed to escape; but, as in this case, the subsequent dangers of the disease are certainly increased by exposing the cavity of the pleura so freely to the air, the operation cannot be justified except it be a measure of absolute necessity; at best, it relieves the patient only for a short time. In the cases of advanced empyema which follow pneumothorax, paracentesis may be performed when the oppression is extreme, and the intercostal spaces are much bulged out. The operation is, however, very far from being devoid of danger; for the free entrance of the air into the cavity, tends to increse the inflammation, and to aggravate the hectic fever. The usual precautions should be carefully attended to after the operation.

If it be thought advisable to perforate the chest, the best mode is perhaps the one performed by Dr. Bowditch of Boston, who states that he has several times performed the operation without difficulty, or subsequent suffering to the patient. He uses a very small trocar, and allows the fluid to flow through it; the instrument is too small to allow of the entrance of any notable quantity of air, and in that manner all mischievous results from the operation are prevented.]

CHAPTER XIII.

HYDROTHORAX.

Although generally applied at present exclusively to dropsical collections in the pleura, the term hydrothorax, may from its origin—ὑδωρ, water, and θωραξ, chest,—be applied to any case of serous effusion within the cavity of the chest. In this cavity three kinds of dropsy may exist. In the first place, there may be dropsy of the parenchyma of the lungs, called pulmonary œdema; secondly, dropsy in the pleural sac, and thirdly, dropsy of the pericardium. The former of these varieties is already treated of; the latter will be considered when I treat of diseases of the heart. Only of that serous effusion, therefore, which distends the pleural cavity, I shall speak in this place.

Pathology.—The pathology of the pleural variety of hydrothorax, is, in some respects, similar to that of chronic pleurisy. The liquid effusion, however, is serous and not purulent. In color it is more frequently yellowish or brownish, and sometimes is tinged with blood. The pleura is not, in many cases diseased and in this respect, it differs from chronic pleurisy. It is apt to be associated with tubercles in their earlier stages of development. Like other forms of dropsy the effusion often depends upon inflammation of the secreting membrane. Some authors consider the effusion arising from this cause as distinct from dropsy; but they fail to assign a good reason for the distinction. Whatever is its origin, when the effusion is serous in its character,

it must be considered dropsical. A very reasonable explanation of the phenomenon is, that the pleural membrane is irritated, and that the congestion of the blood-vessels, is relieved by the serous effusion, before the inflammatory process is far advanced.

In the pleural sac more or less serous fluid after death is frequently found, which, during life had caused but little disturbance. This may be the result of effusion in the dying state, or of chemical changes occurring after death. To constitute dropsy the effusion must be sufficient to derange in some degree the functions of life. Whenever existing in this manner, it causes extreme difficulty of breathing, always increased by exertion, by walking, running or ascending heights, or by the horizontal posture.

Diagnosis.—*General symptoms.* When the effusion is small, the dyspnœa is not great, but as fluid collects, the difficulty of breathing increases. In general, the patient lies on the side affected, and is most comfortable when the shoulders and chest are elevated.

In the advanced stage the horizontal position causes great suffocation, from the tendency of the fluid when the patient lies down, to impede the pulmonary functions. Sometimes placing the patient, during a few moments on his back, may cause sudden death. Preceding such a result, there are a livid or purplish hue of the face, and an almost black appearance of the lips, caused by a deficient oxydation of the blood.

In many cases, it is associated with other forms of dropsy. Anasarca, dropsical swelling of the eye lids, especially in the morning, and in the evening œdematous swelling of the feet, frequently accompany it through most of its progressive changes.

Special symptoms. The affected side is dilated so much in some cases, as to be apparent to the eye, and easily known by measurement of the corresponding parts of the chest on opposite sides. The heart, mediastinum, diaphragm, in fine, all adjacent organs, are more or less displaced when the effusion is very copious. The intercostal spaces are bulging, and the ribs farther separated than natural. By succussion, a splashing sound may sometimes be produced. The vibrations of the chest caused by

the voice, over the side in which the effusion exists, are less easily felt by the application of the hand. Fluctuation is sometimes perceptible on placing the left hand on the chest, and with the other percussing near to the position of the former, and over an intercostal space. Bichat considers increased dyspnœa caused by pressure upon the abdomen, a useful diagnostic sign.

From chronic pleuritis it may be, in general, distinguished by the absence of acute pain, and of the general and local signs of inflammation; and by the extreme difficulty of breathing, which at times, comes on in paroxysms. It is attended by dropsy of some other part of the system, much more frequently than pleuritis.

The physical signs of hydrothorax resemble very much those of effusion from pleuritis. "There will be less dullness on percussion, and diminution of the respiratory murmur in the dependent parts of the chest; and afterwards we have egophony in the middle regions; but as the effusion is seldom so extensive in hydrothorax as in pleuritis, or so much confined to one side, we do not get that abolition of the sound on percussion, and of the respiration and voice, or the displacements of organs, or the peurile respiration on the opposite side, which occur in the latter disease."

Prognosis.—The prognosis depends to a great extent, upon the nature of the exciting cause of the effusion. If this can be removed, or if a recurrence of the same causes can be prevented, hope of recovery may be entertained. Spontaneous cures are recorded. Some critical evacuation may be the means of effecting a radical cure. Dr. Watson relates a case in which hydrothorax was greatly relieved by the copious expectoration of a limpid fluid. Instances are recorded in which dropsical effusions have been cured by profuse vomiting of serous matter.

When not dependent upon tubercular disease, the hope of a cure should be much greater. If the pleural sac be simply distended by an infusion caused by a congested state of the pleura, appropriate treatment will generally produce recovery. Under more adverse circumstances remedial agents will for some time give relief, so great and durable, as to lead the patient to hope for complete restoration. But after the temporary removal of the liquid,

it continues to return again and again, until the ordinary evacuents are not admissible in the treatment on account of the increase of debility which they induce. Under such circumstances, of course, the prognosis must be almost hopeless.

Treatment.—In this disease the remedies should be adapted to the particular exigencies of each case. There are, however, certain general considerations to which the practitioner should have reference in the application of curative agents. In the first place, the object should be to correct, as far as practicable, the pathological condition on which the effusion depends. Secondly, to remove by absorption or otherwise, the effusion, by means which, while they attain the desired object, debilitate but little the patient. And thirdly, to support the strength of the system, under the exhausting influence of the disease, or of remedial agents.

The same remedy sometimes fulfills more than one of these indications. When the effusion is the result of an irritation of the pleura,—and strong inflammatory symptoms arise, the relaxing remedies should be immediately prescribed. Diaphoretics and sudorifics, and, if there is very much febrile excitement, emetics, and the use of the vapor bath or warm bath,—all these means are to be applied as necessity requires.

This kind of medication fulfills two indications. It tends to remove from the irritated membrane, by restoring an equilibrium in the circulation, the congestion, and by exciting to activity those vessels which remove from the system *detrita*, it also tends on the well established principle, that "the fulness of the blood-vessels and the activity of absorption are in an inverse ratio to each other," to remove from the pleural sac, the serous accumulation. These means may be employed with much more efficiency, than the ordinary anti-phlogistic treatment which, while it is the cause of present relief, produces such an anæmic state, as to render the patient more susceptible to another attack than before. Another advantage arising from the course of treatment above directed, is the fact, that it prepares the system for the application of other remedies, and for the reception of strength from the ready and good digestion of food.

To the side affected a large irritating plaster should be applied,

and kept on until a free discharge of sero-purulent matter is produced. The kind recommended in the chapter on pleuritis may be used. Cathartics, if rightly administered, proper care being taken during their operation, to keep up a free diaphoresis, are useful. The following is perhaps as good as any :—

℞	Podophyllinæ	gr. i. ad gr. ii.,
	Jalapæ pulveris	gr. x.,
	Capsici	gr. ii.,
	Pottassæ bitartratis	gr. x.
	Misce.	

Give in sirup or molasses.

When, instead of irritation of the serous tissues, we have relaxation or debility with an anæmic state of the blood, or when tubercular disease is the exciting cause of the pleural irritation, the treatment must be modified according to the indications. If the former condition exists, then tonics are the most useful means. These should consist of preparations of iron, or of peruvian bark. Five grains of the pill of carbonate of iron of the U. S. Pharmacopœa, conjoined with sulphate of quinia, may be given three or four times per day ; and it will be found convenient to unite in the same mass some diuretic which the case may require ; such as squills, or some other of which the dose is sufficiently small to admit of easy combination. To these means, the vegetable diuretics should be added as very important adjuncts. Juniper, eupatorium purpureum, aralia hispida, galium aperine, apocynum androsemifolium, and asparagus. The erigeron canadense, a diuretic and tonic, is considered by some, as preferable to the above mentioned articles. "Among the remedies employed," says Dr. Wood, "is the decoction of pipsisewa which is, at the same time mildly tonic, astringent, and diuretic, and is admirably adapted to mild cases of this kind requiring a gentle impression very long continued." Hydrastin salicin, apocynin or apocynum androsemifolium are among the best tonics. The latter article is both tonic diuretic and laxative, and is, therefore, better adapted to these cases than almost any other remedy. In case tonics cause difficulty of breathing, and are not well borne, on account of the inactive state of the digestive organs, the most effectual

means of removing the difficulty, is to give two or three times a day, alternately with the tonic remedies, the compound lobelia pills.

To the above treatment, the use of the vapor bath should be added. This should be continued until the extremities become warm, and the pulse full, and strong at the wrist, and then, before its full relaxing power is felt, which might cause too much debility, the patient should be thoroughly rubbed by assistants, in order to produce capillary circulation. In case there is a deficiency of biliary secretion attended with constipation and feeble circulation of the blood, I have found the following preparation very useful:—

℞		
	Capsici	
	Hydrastis	a a ʒi.
	Fellis inspissati bovum	q. s.

Make a mass, and divide into four grain pills. Dose,—from three to five three times a day. In some cases podophyllin may be added.

When there is no evidence of excitement and none of debility or anæmia, the remedies should be directed to the removal of the effused fluid. [For this purpose no remedies according to Dr. Wood, are more effectual than diuretics. From this class he selects as the most efficient, the bitartrate of potassa. Even when the disease is the effect of tubercular deposits, he, when the strength of the patient will permit, prescribes this in small, but frequent doses, in order by its manner of administration to secure a more potent effect upon the kidneys. His method of giving the remedy is to direct a certain quantity of the salt to be added to a pint of water, or other vehicle in a bottle, and the whole to be taken in wine-glass doses, at certain intervals in twenty-four hours; the caution always being observed to shake well the bottle before using, and then to take the sediment with the supernatant liquid. Half an ounce during the day is usually sufficient; but sometimes it will be necessary to increase to an ounce, an ounce and a half, or even two ounces, in the same period of time. In case it acts too much upon the bowels, it may be proper to check its action by astringents. If there be dyspeptic symptoms, to the bitartrate of potassa there should be added an infusion of

juniper berries of wild carrot seed or some aromatic, as cardamom, fennel or ginger. By Blackwell, squill is considered as peculiarly useful in dropsy of the chest. Beginning with two or three grains three times a day, the dose should be quickly increased, either in quantity or frequency of repetition, until it produces nausea. After this effect is obtained, the remedy should be lessened in quantity and subsequently kept within the nauseating point.

Dandelion is useful when the dropsy of the chest is complicated with disease of the liver. Various stimulating diuretics have been used; such as horse-radish, mustard, garlic, buchu, and copaiba.

The following formula for a stimulating diuretic infusion was much employed by the late Dr. Parrish:—Take of juniper berries, mustard seeds, ginger roots, each bruised ʒ i; horse-radish, parsely-root, each bruised, ʒ ii; hard cider, Oiv; A wineglassful to be taken four times a day.]

Emetico-cathartic remedies, possessing diuretic properties, have been much used in dropsy. The different articles recommended for this purpose, are the bark of the different species of sambucus, the root of black elder, the broom(scoparus) and hedge-hyssop (gratiola officinalis.) The cathartic should be repeated according to the strength of the patient. In general its administration two or three times a week is sufficiently often to secure all the benefit derivable from its use.

Diaphoresis, at present, is not so much depended upon in the cure of dropsy as cathartics and diuretics. But, in hydrothorax caused by disease of the lungs, or pleura, it is of greater service than has been supposed. One reason why its use has been so much abandoned, is the fact, that too much dependence has been placed upon the common means of exciting capillary action, and when these means to a great extent had failed of accomplishing the desired effect, the conclusion was hastily drawn, that no remedies tending to produce copious and long continued diaphoresis, were of much utility. The means upon which the practitioner can, with the most confidence rely in the fulfilment of this design, are the warm or vapor bath, the hot-air bath, followed by the administration of nauseating doses of lobelia, gradually increased

in frequency and quantity, until emesis is produced. The gelseminum, also, promises to be a useful auxiliary remedy in bringing about the same result. In several cases I have succeeded in effecting diaphoresis by the use of minute doses of aconitum frequently repeated. The wet sheet, is also in many cases an easy and most effectual means of producing diaphoresis. The time and manner of its application must of course be left to the discretion of the physician. Immediately after the use of evacuents, strong tonics should be given to prevent a return of the effusion.

Diet and drinks. The diet should be nutritious. That which is at the same time easily digested, and which contains a large amount of nutriment, is in general best for the patient. All unnecessary interference with the habits of the patient should be avoided. Drinks may be given to patients in this disease in small quantities often repeated, according to the intensity of the thirst. No general rule can be laid down in regard to the quantity allowable. In some cases, copious drinking of water or other liquids, tends to produce diaphoresis, and thus acts as a curative agent. But it is in general best to be governed somewhat by the desires of the patient; directing him to use such drinks as tend to act either upon the skin or kidneys. Cold infusions of diuretic articles, old cider, the potus imperialis,* cream of tartar whey, and in some cases of debility, gin,—all these drinks may be used to quench thirst. For the same purpose, I have directed patients to drink freely of Congress water. After the evacuation of the fluids, if the patient is debilitated, a residence near the sea, and frequent bathing in salt water, are very excellent to tone up the system and fortify it against the aggression of new attacks. In one case which came under my care, and in which the use of diuretics was not followed with very salutary effects, the frequent use of the vapor bath and mild emetics of lobelia, together with hydragogue cathartics soon removed the dropsical effusion. Debility, remaining a long time, although the most active tonics were prescribed, I recommended a residence near the sea, and frequent bathing in its water. Improvement immediately commenced, and a radical cure was soon effected.

* Vide mode of preparation, U. S. Dispensatory, p. 562.

In case the remedies above described fail, paracentesis may be resorted to with some benefit, when there is reason to believe, that the disease has originated in mere vascular irritation, or inflammation of the pleura. In other cases it would be a desperate resort, calculated to afford only temporary relief, and yet endangering the life of the patient by exciting fatal inflammation.

But when sudden death threatens from suffocation, the practitioner might perhaps be justified in resorting to a temporary expedient. In all cases it should be employed as a last resort. Directions for the operation are found in the chapter on Chronic Pleurisy.

CHAPTER XIV.

EMPYEMA.

This word from its etymology ἐν in, πυον pus, signifies a collection of pus in any part of the body. Among the ancients, however, it had a signification more extensive than it now has among the moderns. The former applied it to those purulent collections which form in the cavities of the viscera, or in the interior of the principal organs. The latter apply the term empyema to effusions of blood, of pus, or of serum into the cavities of the pleuræ, as well as to that operation by means of which those liquids are removed from the interior of the chest. The effusions in the chest, whether serous, bloody or purulent, are the results of diverse diseases, of which the pathology, symptoms, causes and general principles of treatment have, in the chapter on pleuritis, been considered. I shall, therefore, consider its diagnosis, prognosis, and some of the more specific points of treatment.

Diagnosis.—The diagnosis of this disease, by the ancients, and the moderns, until after the discovery of the physical signs has been considered very uncertain. With pneumonitis, the ancients confounded it. Its sputum they described as "bilious, bloody, yellowish, viscous, greenish or blackish."

The deficiency of the common signs of this disease, was acknowledged by Cullen in his work on pneumonia. "Under this

head, I mean to comprehend the whole of the inflammations affecting either the viscera of the thorax, or the membrane lining the interior surface of that cavity; for neither do our diagnostics serve to ascertain exactly the seat of the disease, nor does the difference in the seat of the disease exhibit any considerable variation in the state of the symptoms."

Physical Signs.—The diagnosis must depend upon the physical signs; the dullness on percussion, the absence of respiratory murmur over the affected side; while on the opposite lung, the respiration is more loud, and somewhat puerile; the metallic tinkling and amphoric respiration are sometimes heard. Fluctuation caused by succussion and the other general and special symptoms described in the chapter on Chronic Pleuritis, are often present.

Prognosis.—In the majority of cases, this is unfavorable. The character of the effused fluid, the constitutional disturbance, the degree of strength, and condition of the lung opposite the diseased one, should be considered in forming the prognosis. Sometimes, the pus spontaneously perforates the parietes of the chest, and is discharged during a long time. The cases of recovery are rare. But sometimes they occur, and therefore, some hope may be entertained of relief and cure either spontaneously or from an operation.

Treatment.—In case the spontaneous discharge of pus is great, and the system shows signs of depression, means should be used to keep up the strength. For this purpose nourishing diet and the strongest tonics should be used. If there is a purulent expectoration, this should be promoted by expectorants, and if there is evidence that the digestive organs suffer from any collection of morbid matter, an emetic adapted in thoroughness or mildness to the exigencies of the case should be administered. In all cases in which purulent or sero-purulent matter is absorbed in large quantities into the blood, the emunctories should be stimulated to action. This effect is produced by the use of the vapor bath. In case there is not much febrile excitement, alcoholic drinks when combined with tonics, expectorants, and nourishing food, are not

inadmissible. Pure wine, porter, or ale, and if the kidneys are inactive, gin may be given to keep up the strength of the system, while the suppurative process is going on. These last means are most serviceable, when the empyema is the result of tuberculosis. In such cases, even when the hectic fever is considerable, their use may be persevered in. If, however, there be fear of producing over-excitement, alternately with the administration of alcoholic stimulants, a pill of extract of lobelia, or some other relaxing and sedative agent should be given.

Mr. MacDonnell has written an interesting article on empyema, in which he relates several cases wherein tumors appeared on the surface of the chest. These were red, tense, pulsating, and shining. At length they burst, giving exit to a large quantity of pus. The empyema attended with these pulsating tumors, he calls the *Pulsating Empyema* of *Necessity*.

Mr. MacDonnell relates several cases of much interest. In one of them, two tumors appeared on the left side, one near the spot occupied by the apex of the heart, the other between the tenth and eleventh ribs near the spine. The opening of the tumors gave relief, but the patient subsequently died of phthisis. In another case, two tumors, each about the size of a hen's egg were observed, one just below the nipple, the other between the tenth and eleventh ribs, about two inches from the spinal column. These tumors were rather tender to the touch, a few turgid veins surrounded their bases, the integument covering them was discolored, and reddish, and they both possessed a well-marked fluctuation, and a distinct, perceptible, and diastolic pulsation. Other cases of a similar nature are related by Mr. MacDonnell. In one case of empyema, the pus made its way into the bronchial tubes, and was removed by expectoration.

These tumors arising from the "*Pulsating Empyema* of *Necessity*," may be distinguished from Thoracic aneurism, by (a), The history of the case. (b), The dullness extending over the whole side, the pulsation being felt only in the external tumor. (c), The absence of thrill. (d), The absence of *bruit of soufflet*. (e), The extent and nature of the fluctuation. From encephaloid disease of the lungs and mediastinum, by (a), The absence of expectoration resembling *black currant jelly*. (b), The absence of

persistent bronchitis. Such cases as above described are not often found. Occasionally they may supervene in consequence of badly treated acute pleuritis. I have seen one case similar to those described by Mr. MacDonnell. The fistulous opening was upon the left side of the spine, about an inch exterior, and between the tenth and eleventh ribs. From a gill to a pint of pus was discharged daily for about a month, gradually diminishing in quantity, until at the end of three months it ceased. By the use of mild emetics and tonics, of which the wild cherry, and sirup of the iodide of iron were the most important, a comfortable degree of health was obtained. The affected side was left permanently contracted. Empyema has a peculiar effect upon the functions of the liver. This organ is enlarged from an engorgement with blood. This enlargement is evidently identical with that which takes place in other affections of the lungs and heart, where, in consequence of the partial suspension of their functions, an additional amount of labor is thrown upon the liver. The removal of this enlargement is one of the first signs which indicate the subsidence of the effusion, and the return of the compressed lung to the performance of its normal functions.

CHAPTER XV.

PHTHISIS.

The word phthisis, from the Greek φθίειν to waste away, signifies a gradual decay of the body. By this term is meant a state of continued and slow consumption, not exclusively of any one part, but of the general system. It is a generic term, applying equally well to organic changes in the various organs of the body. Such specific terms to the generic, are appended as most definitely indicate the location of the disease. Accordingly we have laryngeal, pulmonary, intestinal or mesenteric, hepatic and gastric consumption, described by authors. These distinctions are somewhat arbitrary; all kinds of consumption being a constitutional rather than a purely local affection.

The term *pulmonary* is used to denote a decay of the lungs;

but since other diseases produce this effect, it is necessary to restrict its application to those cases in which tubercles are the exciting cause of the disease. This definition being adopted a decay of the lungs arising from bronchitis or pleuritis, uncomplicated with tuberculous deposition, cannot properly be considered consumption.

Tuberculous phthisis as thus defined is by far the most formidable disease of the thorax. No other is so sure to terminate the lives of its victims, and so little under the control of medication.

Section I.

TUBERCLES.

Pathology.—The pathology of phthisis was but imperfectly understood by the ancients. Of its nature the Grecian Father of Medicine, Hippocrates, had no accurate knowledge. He recognized the existence of tubercles, and attributed their cause to petrified phlegm. With this error of Hippocrates, Galen associated the idea that they were caused by the descent of humors from the head, or by the putrefaction of effused blood. To Sylvius, whose works were published in 1679, belongs the honor of first giving a scientific explanation of their nature and origin. With scrofula he showed their connection, of phthisis he considered them the cause. To the degeneration of certain invisible glands in the lungs, he attributed their rise. By his successors, by Morton and Broussais his opinions were adopted. In 1733 Desault revealed to the world the result of thirty-six years of investigation into the nature and causes of consumption. His view, that it was dependent upon the formation of tubercles, was entertained by Russel Halles, Gilchirst and Mudge. By the more recent researches and investigations of Stark, Bayle, Laennec, Louis, Andral and Carswell, the anatomy of tubercles and their course of development, is now rendered more accurate and complete than that of any other morbid product. And yet diverse opinions respecting their nature and development still prevail; and doubtless that diversity will still exist until chemistry shall have attained

an ultimatum, until optics shall have reached that limit beyond which art and science can never pass.

At present, the more general opinion is, that consumption is a constitutional disease, most often producing its greatest lesions in the chest. The essential character of pulmonary consumption, consists in the deposit of tubercles in the tissues of the lungs. This deposit may begin with local mischief, or may evidently be a sequel of constitutional disorder. In both varieties the general disease is present; although it may exist in a latent form. Of this, the formation of tuberculous matter is a proof. It is evident, however, that the presence of tubercles does not alone constitute the disease. One step back, along the chain of causation is a morbid condition, of which tubercles are but the effect. This morbid condition, whatever is its nature, may exist a long time, before the deposit of tubercle begins.

That a change takes place in the blood, which causes or precedes the deposit and development of tubercles, is well established. The corpuscles are diminished and the albumen increased in quantity. The fibrin is below rather than above the normal amount, and, it may be inferred, that it is also defective in its nature. Elsner, and some other analysts, have found the fatty principles diminished. Dr. Tricke's analyses indicate an increase, above the standard of health, in the lime and a decrease in the phosphates; while l'Heritier states, that in scrofula, the earthy salts are diminished. Hence, the blood may be stated generally to be degraded in quality, and endowed with a low degree of vitality. Whether these be the real changes in the blood is not certainly determined. Physiologists and pathologists are not fully agreed as to the nature of all the changes through which the blood passes, in the scrofulous diathesis. Andral showed that in phthisis pulmonalis, the fibrin was augmented. The probability is, that this increase of fibrin is most frequent when intercurrent pneumonitis is associated with the tubercular disease. To attain to accuracy in this matter is very difficult, on account of the variable state of the blood arising from diet, exercise, time of the day, and other changing circumstances.

Some general results of agreement, however, are established. These prove without doubt, that the blood corpuscles and fatty

principles are diminished in quantity, whilst the albumen is comparatively augmented,—a change which seems well proved by all the chemical, physiological and pathological researches with which we are acquainted. Such a condition of the blood of course, causes a deviation from the perfect physiological standard of the corporeal functions. The symptoms, indicating the existence of such a state, are constitutional debility, from a deficiency of nutrition. Hence the waste which takes place in the colored corpuscles, and in the muscles and other tissues.

[The conclusions to which we may logically come are the following:—1, That from the earliest invasion, the sum of the vital force is either below the standard of health, or it is relatively low as respects the structure and organization of the individual;—2, That this diminution in the sum of vital force, is dependent on the imperfect blastema of the diseased blood causing perversion of the tissues;—3, That as tuberculosis advances, the sum of the vital force for the whole system continues to diminish;—4, That the nutritive powers of the blood, as respects the nervous tissue, frequently remains undiminished, this tissue not requiring for its nutrition, compound principles identical with it to be introduced into the blood with the food, and having a nutrition peculiar to itself, differing from that of the cellular and muscular structures.

The fatal disease, tuberculosis may be traced to a primary error or defect in the blood-making process. Vitiated air, or air stagnating or insufficiently renewed within the chest; and probably other anti-hygienic influences, as a vitiated or defective diet, acting singly, coetaneously, or as respects each other ancillary, produces, slowly under ordinary circumstances, but occasionally with great rapidity, some unknown change in a portion of the proteiniform principle of recently formed liquor sanguinis; this change may consist in hyper-oxydation, but whether so or not, it deteriorates its properties, rendering it more or less or altogether unsuitable as a material for organization.

At the same time, the oily principle of nutrition, circulating with a diminished number of red corpuscles, is, in part, converted into a fatty substance of a lower degree of oxydation. These modified proteiniform and oleaginous principles are exuded in the blastema, and are either employed in the assimilating processes,

deranging the nutrition of many of the organic structures, and giving the tuberculous or scrofulous character to various pathological processes; or, in the more advanced stage of the morbid process, they are deposited in particular tissues, and accumulate, generally in the form of tubercle, but sometimes both as tubercle and morbid fat; substances, for the most part, incapable of organization. In the present state of pathological science, confining ourselves to its legitimate object, the study of *phenomena*, apart from any metaphysical views of final causes relating to the *powers* of nature, this appears to be the most accurate definition that can be given of the most essential nature of tuberculosis. [Dr. Ancell.]

Though we no longer believe in the elements of *Thales*, we may, without a great stretch of the laws of the natural sciences, admit that air is the chief element of health or disease, according as it is supplied to the lungs in its unadulterated condition of four-fifths nitrogen, and one-fifth oxygen, or as it carries, diffused through it, carbonic acid gas, carbonated hydrogen, sulphureted hydrogen, the effluvia of cess-pools and drains, the poison of influenza or cholera, the eminations of the variolous or typhus patient.

But in what manner does the deposit take place? We possess sufficient evidence to show that it is derived from the blood; that it transudes from the capillary vessels of the part in which we find it; and that, after having been deposited, it is liable to undergo certain further changes. On a close examination of incipient tubercular deposit, we may always note that there is congestion in the tissues immediately surrounding it. In the pia-mater of the sylvian fissure, we see an increased redness in which a few vessels are more prominent than usual; in the pulmonary parenchyma we may, especially, by the use of the microscope, discover the engorgement of the interlobular capillaries investing the air vesicle into which the tubercle is being secreted; in the mucous membrane of the intestines, we see the exquisite arborescent arrangement of the congested vessels, tending from the mesenteric attachment to the point where we observe the deposit shining through the mucous surface from the sub-mucous tissue in which it has collected. The first elimination of the morbid products

acts like a magnetic point of attraction, and generally serves as a centre around which the deposit progressively enlarges by eccentric deposition.

The amount of vesicular action accompanying the elimination, varies in different individuals; in some there is scarcely a perceptible increase in the sanguinous current, in others, we cannot deny the presence of acute inflammation, shown both by the congested state of the blood-vessels, and by the presence of plastic exudation, and exudation corpuscles. In ordinary inflammatory conditions, we may actually observe the part taken by the capillary vessels in the process of transudation. We see the inflammatory product immediately after its passage through the vesicular membrane, coating the vessels; and, we may see the same matter within the vessels adhering to the coats previous to its discharge.

Whether it be so or not, whether we may be enabled to observe the transition of the contents of the vessels into the surrounding parts or not, it is evident that we ought not to be satisfied with ascertaining the fact of the exudation as the primary change. We are driven to take one step more, before we gain the fountain-head of the malady; we therefore look to the constitution of the blood itself in tubercular disease, in order to ascertain whether any deficiency in the normal components, any variation in their relative amount, any new products are to be met with, which may explain the source of the extravascular deposit. All observers, who have brought either the microscope or chemical analysis to bear on this subject, are agreed, that there is an alteration in the blood, indicating a want of vigor and tone. [Dr. Sieveking.]

This abnormal condition of the blood, to a limited extent, is doubtless, the predisposition to phthisis of which authors speak. Consonant with this opinion Mr. Ancell, in his work on "Tuberculosis," remarks:—"The predisposition differs from the general disease only in degree, and the condition of the blood in the predisposition is the same, differing only in degree."

But one thing more is wanting in order to the attainment of any practical result. We want a positive and conclusive sign by which the predisposition may be recognised. Such an indication of this incipient condition of tuberculosis would be of extreme value; for, as the diagnosis of diseases of the thorax has improved,

our treatment of these diseases has commensurately acquired greater simplicity and certainty. Although, in the opinion of some, the organs of oxygenation have a greater share in its development, than other organs, yet the stomach is no doubt a prominent agent in the production of phthisis. Whenever this organ, in consequence of debility or any abnormal change, does not properly furnish nutriment to the blood through the digestive process, a reduction of vitality must be the consequence.

Baudelocque, however, shows a very intimate connection,—as cause and effect,—between the results of vitiated air and scrofulous disease. But notwithstanding this, we must from reason as well as from experience, conclude, that the effect of vitiated air upon the respiratory organs and through them on the blood, acting coetaneously with the effect of dyspeptic disease of the stomach upon the blood, is much more sure to produce tuberculosis than when the stomach is in a healthy condition.

The illustrations used by Baudelocque, to show the tendency of impure air to develop tubercles, are forcible and convincing. Speaking of the shepherds of his country, who, for the most part, lead an open-air life, he says, that in them the cause of the disease is their habit of sleeping six or eight hours in confined huts which they transport with them, having only a small door, that they close when they enter, and keep closed during the day. A similar injurious effect is produced by the habit of sleeping with the head under the clothes, and the insalubrity of school rooms in which a number of children are assembled together. These causes frequently repeated, are prolific in the development of any latent germs of phthisis which may be existing in the blood.

Close rooms, Dr. Arnott has pithily remarked, "act like extinguishers to the vital flame; and the extinction literally takes place at the point at which the fuel accumulates for want of being burnt off."

Since the blood is the true source of the tubercular deposit, it is not surprising that all the organs of the body are more or less liable to become the seat of the morbid product. Some tissues present a greater proclivity to the deposition than others; and some, as the fibrous and tegumentary tissues, appear to enjoy almost an immunity from tubercle. At the two ends of the scale,

we may place the mucous membranes and fibrous tissues; the former are the native soil for this tree of death; the latter are rarely, if ever affected. There can be little doubt, that this depends, in a measure, upon certain physical laws, influencing the current in the vascular system, and determining the greater or less facility of transudation in the first instance.

To show that the deposit of tubercle is in the mucous membrane of the lungs, is more difficult than to show its location in the mucous membrane of the fallopian tubes and uterus, because these latter organs, on their internal surface, are lined with mucous membrane, so abundant as to be easily recognised. The more slow and the more free from complication, the tubercular disease of the lungs is, in its nature, so much the more readily may be detected the disease of the mucous membrane, and the tuberculous deposit in it.

Dilatation of the air-cells in emphysema has enabled Dr. Alison to distinctly perceive the tuberculous matter contained in these cells. [Edin. Medi-Chro. Trans. vol. i. p. 427.]

[Dr. Sieveking observes,—"that we may lay it down as a law, regulating the deposit of tubercle, that it is effected at that point of an organ or of a tissue where the smallest amount of pressure is exerted upon the capillary system. This does not exclude the operation of other laws which determine the attraction to any one organ. It does not offer any reason why in one case we find tubercle in the spleen, in another in the mesenteric or bronchial glands, in a third exclusively in the pulmonary tissues; but it seems to embrace the various circumstances modifying the exact site of the deposit in these different parts of the system. The *vis a tergo* varies but little in the different parts of the capillary system; but the relation to surrounding tissues differs very much. Thus, while the force with which the blood is driven into the interlobular plexuses of the lungs is identical, the pressure which the respective capillary systems meet with in a case of congestion, which implies a tendency to exudation, is necessarily greater in the bone than in the soft parenchymatous structure. No organ is more frequently the seat of tuberculous deposit than the lung, and in none do we find the capillary ramifications of the vessels with so little covering. They almost lie naked on the surface.

Beyond the basement membrane forming air vesicles, and possibly a delicate epithelial layer, there is nothing between the capillary net-work and the atmosphere. We need not, therefore, wonder that the ultimate vesicle, in which the bronchi terminate, is above all other points, that of tuberculous election. The receptacle is ready, the product being in the blood, a slight increase of pressure will overbalance the natural and healthy equilibrium between the external and the internal fluids, and the discharge takes place.

If this view is correct, nothing but a previous change in the ultimate vesicles, or bronchules could give rise to a deposit of tuberculous matter in the intervesicular tissue, in the parenchyma of the lung itself, as contradistinguished from the respiratory cavities. We can suppose that obliteration of a portion of the breathing apparatus might leave the intervesicular texture less resistent than the air vesicles; and, in that case, we should expect to find an interstitial deposit. Whether this does actually occur, I am not prepared to say. I have not seen any appearances that would justify the assumption of a primary interstitial deposit, but I have seen a distinct deposit of tuberculous matter within the air-vesicles, and I have traced its primary deposit in the semi-liquid form, in the solitary vesicle, to the deposit in numerous adjoining vessels, causing destruction of their breathing power and obliteration of the bronchule terminating in them. The ultimate bronchule is free and patulous, and the tuberculous matter fills the vesicle as a bullet fills its mould.

The law, that the tendency to the deposit in an organ, is inversely as the pressure the vessels sustain, or that it is in the ratio of the laxity of the tissues, is supported by the views which are commonly held with regard to the chemical constitution of tubercle. This law, also assists us in explaining, why certain parts of different organs possess so marked liability to become the seat of tuberculous exudation. This feature constitutes an essential difference between tubercle as a mere effusion of a certain constituent of the blood, and those other new formations in which we cannot but see a tendency to independent development, or organization. The most familiar instances of pathological processes with which it may be compared, are the serous effusions, that

take place into the peritoneal cavity, from obstruction to the vena cava or portal system, inducing congestion and consequent liquid discharge at the most yielding points.

If we adopt this view of the subject, it appears to offer an explanation of the circumstances that the apices of both lungs are the chief seats of tubercle, while it tends to show the importance of encouraging the use of all the physical means at our command to promote a free and active circulation of the entire vascular current, and to obviate and anticipate anything approaching to local congestion in the organs and parts of organs which we know to be most liable, at different periods of life, and under different circumstances, to become affected with the disease in question.

The manner in which the law may be applied to the explanation of the predominant proclivity of the pulmonary apices, is simply this:—The upper portions of both lungs are surrounded by more unyielding parietes than the inferior, they have less room for expansion; consequently, if there is any increase in the vascular current supplying these parts, the difference between the pressure of the parietes and of the atmosphere within the vesicles will increase unduly, and effusion will take place into the latter. In acute tuberculosis, we do not observe this peculiar election, because the process is of a more active character; the strain upon the capillaries of the entire organ is greater than they can bear, and we consequently find the deposit takes place with much uniformity throughout the lung.

In chronic forms in which tuberculous deposit generally occurs, the balance of the forces in different parts of the vascular system, is in a measure preserved, and only the very weak points are assailed. There may be other forces which come into play; there may be elective affinities between different tissues, and morbid products with which we are as yet not even acquainted. The circumstance above alluded to, is one of some importance. In scrofulous deposit in the kidneys where does the tuberculous matter invariably present itself? In the loose texture of the cortical substance. The dense basement membrane and firmer epithelial coat, wards off the encroachment; but the feebler texture of the convoluted tubes is unable to repel the enemy.] Another cause of the more frequent location of tubercles in the superior lobes of

the lungs, has been suggested, which seems somewhat plausible, and is a useful hint to the treatment required in tuberculosis. The increased motion of the lower lobes of the lungs, would cause a more ready expulsion from the vesicles of tuberculous deposits, than would take place in the apices. In the vesicles of the apices, on account of their want of expansion, there would evidently be a tendency to accumulation, while in other parts of the pulmonary tissue the reverse would be true. So that, on this hypothesis, there might be an equal amount of tuberculous matter exuded into the vesicles in all parts of the lungs, and yet, on account of its more ready expulsion from one part of the lung than from another, the development of tubercles, as experience verifies, be most active in the apices.

"Tubercles exist in various forms; in fine points, gray and yellow granulations, miliary tubercles; and gray or yellow tubercular masses, softened and cretaceous. Each of these modifications requires a more particular notice.

"1. *Pulmonary Granulations.—Gray Granulations.—Miliary Tubercles.*—These various names, have been used by authors to describe round, small, translucent, shining, homogenous bodies, often not larger than a millet seed, but varying from this size to that of a pea, which appear to be the primitive state of tubercles. Usually they are of a grayish, but often of a reddish, or of a brownish color; and in some cases they are nearly colorless. Sometimes they are isolated, sometimes clustered in small bunches, or in aggregate masses. In the latter state they are most often found in the upper portions of the lung. But in an isolated form they are sometimes scattered thickly throughout the whole or greater portion of the pulmonary tissue; not unfrequently they are found situated beneath the pleura, producing an irregularity perceptible to the touch. This is more often the case in children than in adults.

"2. *Gray Tubercular Infiltration.*—Laennec defines this as the same kind of matter which forms the granules above described, deposited in the cellular tissue of the lungs in irregular masses, sometimes one, two, or even three inches in cubic dimensions, without definite boundaries, or limited only by the extent of the lobules. It is hard, homogeneous, translucent, and of a grayish

color, sometimes darkened by the black matter of the lungs, portions of which become enveloped in the masses as they are formed. In some instances, no traces of pulmonary tissue can be detected in the masses; in others, they present remains of blood-vessels, bronchial tubes, and cellular membrane; and occasionally they are partially penetrated by the air in respiration.

"3. *Gelatinous Infiltration.*—Under this name Laennec described a colorless or rose-colored substance, more transparent than the gray matter noticed in the last paragraph, and of a jelly-like consistence, which he had observed to be deposited in small quantities in the tissue of the lungs, in the intervals of the tubercular granules, and which he believed to be gradually converted into proper tuberculous matter. Louis states, that he has met with this species of infiltration, but has not noticed in it the yellow tuberculous points spoken of as not uncommon by Laennec. Dr. Morton in his Illustrations of Pulmonary Consumption, gives two cases in which the tuberculous transformation appeared to have commenced in this gelatinous matter.

"4. *Crude Tubercle and Yellow Tuberculous Infiltration.*—The gray translucent matter constituting the first two deposits above noticed, appears to undergo a gradual conversion into what has usually been considered the proper tuberculous substance. In the miliary granulations, the transformation commences in a small yellowish-white spot, which most commonly appears at or near the centre, and gradually enlarges until the whole granule assumes that character. In this altered state, the little bodies are now generally denominated *crude tubercles.* In the aggregated granules, the change commences at several points, each probably answering to a distinct granule; and considerable masses of yellow opaque matter result from the extension and ultimate coalescence of these central spots. The same transformation takes place in the infiltrated translucent matter, beginning in like manner with isolated opaque spots, and spreading until it involves the whole deposit, which, when thus altered, receives the name appropriated to it by Laennec of *yellow tuberculous infiltration.* This may be distinguished from the crude tubercle by an irregular and angular, instead of roundish form, and by a less definite line of division between it and the pulmonary tissue. There is no doubt,

that both the crude tubercle and yellow infiltration are often originally deposited in this state, without the preliminary formation of the translucent matter.

"*Progress of Tubercles.*—The yellow tubercle, whether original, or the result of a transformation of the gray granulation, gradually increases by new accretions. As observed upon dissection, it varies in size from the magnitude of a pea to that of a hen's egg, is irregularly roundish, and consists of a yellowish-white, opaque, friable substance which easily breaks up between the fingers. In relation to its chemical composition, microscopic characters, and peculiar constitution, the reader is referred to Dr. Wood's article on tuberculosis." [Wood's Practice of Medicine.]

The next change in tubercle is that of softening. This, by many authors, is said to begin in the centre, and to gradually advance to the circumference. Concerning the truth of this, there is however, some doubt. The reasons as given by Mr. Carswell upon which such a doubt is based, are the following:—Tubercular matter according to his theory is contained in the air-cells and bronchi. If, therefore, this morbid product is confined to the surface of either, or has accumulated to such a degree, as to leave only a limited central portion of their cavities unoccupied, it is obvious that when they are divided transversely, the following appearances will be observed:—1st. A bronchial tube will resemble a tubercle having a central depression or soft central point in consequence of the centre of the bronchus not being, or never having been occupied by the tuberculous matter, and of its containing at the same time a small quantity of mucus or other secreted fluids:—2nd. The air cells will exhibit a number of similar appearances, or rings of tuberculous matter joined together, and containing in their centres a quantity of the same kind of fluids. When the bronchi or air-cells are completely filled with tuberculous matter, no such appearances as those we have just described are observed, and hence the reason why tubercle, in such circumstances, has been said to be still in the state of crudity, or in that state which is believed to precede the softening process.

The term encysted has been applied to tubercles. But this term is liable to deceive. The walls of the cyst are nothing

more than the parietes of the vesicles distended with tuberculous matter. A biliary duct distended by a morbid deposit, has, likewise, been called through the same mistake, an encysted tubercle. As the softening process advances, the whole tubercle becomes converted into a "soft, pultaceous, yellowish mass," in appearance resembling pus. The infiltrated mass, likewise, undergoes a similar change. Sometimes the entire tuberculous deposit seems throughout its whole mass, to become suddenly softened; and, in this manner, large portions of the lung are quickly destroyed.

The pressure of the growing tubercles upon the circumjacent lung at first, makes it less vascular. But reaction at length takes place, and inflammation succeeds; and congestion, ulceration and suppuration follow. In some cases the tubercular disease passes through its various stages without giving rise to marked inflammation. In the majority of cases, however, the bronchi, air-cells, and cellular tissue, are more or less affected by the inflammatory process. The succeeding ulceration gives rise to the formation of cavities. Frequently one large vomica is made up of several smaller ones, which in the parietes of the large cavity, make excavations of irregular shape, now winding, and now crossed by bands of tissue. The size of the cavity varies from that of a pea to that of an orange. Its contents consist of a mixture of pus and bloody matter, and portions of pulmonary tissue. Sometimes they are inodorous, sometimes fetid. In children the vomicæ are less common, than in adults. As the disease advances, a false membrane begins to form around the decaying tubercle, at first thin and delicate, but subsequently becoming more dense and fibrous. In some cases it is composed of layers, resembling fibro-cartilage, in others remaining delicate, and in appearance resembling mucous membrane. Large abscesses are sometimes seen, between which and the bronchi there is no communication.

Cicatrization of Tuberculous Cavities.—That this is not a very rare occurrence Laennec proved in his early researches into the termination of tuberculous disease. Indeed, from this we learn that phthisis sometimes terminates favorably. This happens when the deposit is limited in extent. But sometimes, at the apex of the lung we find an old adhesion, sometimes a crust of fibro-cartilaginous deposit, or even a fibrous band passing from the lung

to the ribs. Adjacent to this pathological change, the lung is puckered, and drawn inward. To the touch it feels firm and consolidated; to the eye it appears dark, from an abundant deposit of black pigment. On making an incision we find a cavity, lined by "gray fibrous membrane, semi-transparent; or thick, whitish and fibro-cartilaginous; or soft and pliable, like the mucous membrane."

This cavity is usually about the size of a pea or a plum, and not unfrequently opens into the bronchi. It contains a transparent viscid fluid, and in some cases tuberculous matter partly transformed into cretaceous substance. Around the cavities, the lung is more or less indurated by chronic inflammation. In some cases they are filled with fibro-cartilaginous formations, which almost obliterate the vomicæ. At the summit of the lungs, other evidence of the previous existence of a curative process, sometimes exists. There are adhesions, and indurations similar to those in other parts of the pulmonary parenchyma, but in the vomicæ there are also small masses of a chalk-like appearance, of stony hardness, feeling gritty or earthy to the touch. These small bodies have been called ossifications, but they are effects of progressive changes in tubercles. Galen and Paul of Egina, Bonnet and Schenck saw them in great numbers; and Bayle considered them as one of his six forms of phthisis. By Laennec these concretions are divided into *cartilaginous, osseous, petrous* and *cretaceous.* These are seldom numerous, and are most often found at the summit of the lungs. Their size and number are so small that we may reasonably conclude that they must have originated from a limited deposition of tubercle. Every thing connected with their history, would seem to prove that they are the effects of that natural process, which nature institutes to remove the disease. Laennec well remarks "that they show in a train of diseased action that tubercles are cured." Sometimes they remain in a latent state, not exciting irritation or inflammation.

But how are these concretions formed? To this question Dr. Swett replies, "they are effected by the deposit of mineral matter, the chloride of sodium, the sulphate of soda united with a little phosphate and carbonate of lime, and sometimes with cholesterine in the place of the proper matter of tubercle. But every stone-

like concretion that is formed in the lungs is not necessarily a converted tubercle. This condition may result also from a deposit of lymph which passes gradually into a cartilage-like or bone-like condition, or it may be owing, as some think, to a partial ossification and obliteration of the smaller bronchial tubes." Andral's opinion was that they are formed by the solidification of mucus in the minute branches of the bronchi.

The *seat of tubercles* has been a subject of much diversity of opinion. Some have located them in the glands. Of this, Dr. Wood remarks that there is no proof. Some contend that they are the result of effusion into the air-cells; others that they have their seat in the radicles of the veins, and still others that their location is in the bronchial tubes and inter-vesicular tissue. These diverse opinions should lead to the conclusion that tuberculous deposition takes place in many, if not in all of the tissues of the lungs.

More often tubercular cavities are situated towards the posterior part of the lung, than the anterior. One lung according to Louis, is more liable to this deposition than the other. "Modern observers have collected numerical statements showing that this really is so. Why it should be so, I know not. Thus Lonis, whose volume is the result of immense labor in observing, and is full of the most instructive matter, had met with *seven* cases in which tubercles were confined to a single lung; in *two* of the seven cases it was the right lung that was thus exclusively affected, in *five* it was the left. Of 38 instances in which the upper lobe was totally disorganized by the disease on one side, 28 were of the left, and only 10 of the right. Eight times he had known the pleura perforated by the extension of tubercular disease; and seven times out of the eight the perforation happened on the left side of the chest. So also Reynard met with 27 cases of pneumothorax on the left side, to 13 on the right. No less curious is it that here also the facts ascertained with respect to pneumonia, are just the contrary of those which belong to phthisis. I mentioned, in a former lecture, Andral's conclusion, derived from the observation and collection of 210 examples, that pneumonia is more than twice as common on the right side, as on the left. M. Lombard, of Geneva, found the ratio somewhat less than this, but

still great. Of 868 instances of pneumonia, 413 occurred on the right side alone, 260 on the left alone, and 195 on both sides at once. That is, there were three on the right side alone, for every two on the left alone." [Watson's Lectures.]

In very many cases, however, tubercles are found in both lungs, in each, the severity of the disease being about equal.

Tubercles vary greatly in number and in the form of their deposition. Sometimes they are nearly isolated, at other times, they are found in successive crops, and in every stage of development. Indeed *post-mortem* examinations, often reveal several cavities, miliary, crude tubercles, and tuberculous infiltration existing together in the same lung—the marked effects of successive crops of tuberculous deposition.

Bayle described certain semi-transparent oval, flattened bodies, about equal in size, and scattered through the lungs, to which he gave the name of accidental cartilages. Their appearance is somewhat similar to miliary tubercles; from which they may be distinguished by their more uniform size and their more equal distribution.

Adhesions are almost always present in phthisis. In 112 cases examined by Louis, there was only one in which no adhesion was found. To some extent their location corresponds to that of tubercles. In rare cases, the entire surface of the lung is bound down to the costal pleura, and to that of the diaphragm. These have the effect to prevent pneumothorax. The trachea and bronchial tubes often are the seat of extensive lesion. Those are most often affected which form a way of exit to vomicæ. Their posterior, more often than their anterior internal surfaces are affected. The larynx and epiglottis are sometimes the location of tuberculous disease. Among other lesions attending phthisis, are partial emphysema of the lung, dilatation of the bronchi, and enlargement of the bronchial glands. This latter effect is most common in children.

Appearances in other parts of the body.—The origin of tubercles being in the blood, their distribution throughout the entire system, is a necessary result. But according to Louis, this general law is established, that when tuberculous deposit exists in other organs, it always exists in the lungs. The converse of this, is

far from being true; and the law itself, is occasionally subject to exceptions, the occurrence of which is most frequent in children. Without the lungs the tuberculous depositions most often are composed of the yellow, opaque tubercle. Gray granulations or miliary tubercles, have also been observed in various parts of the body. From some form of tubercle, scarcely an organ of the body is wholly exempt. They are found in the liver, intestines, mesentery, prostrate gland, testicles, heart, bladder, uterus, spleen and kidneys, and in the membranes and substance of the brain. It was the conclusion of Louis that, of all the cases of tubercles occurring in persons over the age of fifteen years, one third had them in the small intestines, one fourth in the mesenteric glands, one ninth in the large intestines, one tenth in the cervical glands, one twelfth in the lumbar glands, and one fourteenth in the spleen. The stomach becomes larger than natural, more thin, and is subject to chronic inflammation of its mucous surface. The glands of Peyer,—those near the cæcum,—become the seat of tubercles. The mucous glands of the small intestines sometimes ulcerate, causing perforation and the admission of the fæcal secretions into the cavity of the peritoneum. A similar diseased state of the large intestines sometimes occurs. The mesenteric glands are very much enlarged. In the brain, tuberculous deposition gives rise to hydrocephalus.

Section II.

General Symptoms and Course of Phthisis.

Since the discovery of the physical signs by Laennec, the tendency of some minds has been to disregard the general symptoms in the formation of a diagnosis. Among such, an unnecessary delay is often caused in the application of remedial agents; for the general symptoms very frequently are the first indications of approaching disease. A diagnosis should not then be wholly dependent upon the physical signs in the first stage; for these are seldom manifest until the disease has so far progressed as to make a prognosis unfavorable.

Certain general symptoms are grouped together, and said to be

indicative of the *scrofulous diathesis* or *tuberculous cachexia.* What this condition of the system is, or what its influence, in the development of phthisis, it may be difficult to accurately ascertain, and yet the description of some of its more important symptoms may be of utility in detecting that first pathological change in which phthisis begins.

Among the more important symptoms, are a pale, pasty, appearance of the countenance, large upper lip and alæ nasi. In persons of a dark complexion, the skin is sallow, in those of fair complexion, it is unnaturally white, resembling blanched wax rather than the healthy countenance. The veins are large and conspicuous, the pupils of the eyes are large, eyelashes long, with a fair, florid complexion. In persons of a bilious temperament, the skin is coarse, its color dingy. The form of the body is often destitute of symmetry. The head is large, trunk small, abdomen, tumid, limbs unshapely; the growth of the body is irregular, the functions of nutrition are feeble, and deranged. The intellect is often very active, there is great sensibility to impressions and acuteness of mind.

The bowels are usually more or less irregular, more often slow in their action than the reverse; the urine turbid, the skin soft, dry and flaccid, or dry and harsh. The muscles are soft and destitute of much firmness of texture and the circulation is feeble. There is a great tendency to catarrhal affections, which are prone to continue a long time and to cause a discharge of thick yellow mucus.

In children, the eyelids and ears are often subject to chronic inflammation. The fauces and tonsil glands are seldom free from chronic disease. The lymphatic glands enlarge on slight exposure. The catamenia in females are tardy in their appearance, irregular in their return.

Stages.—For convenience in description, phthisis has been divided into three stages. Between these no line of demarkation is accurately drawn. The first stage begins with the onset of the disease, and ends when softening of tubercles, has commenced.

General Symptoms.—The pulse is accelerated, especially after eating, towards evening, or by slight exercise. A burning sensation is felt in the palms of the hands and soles of the feet. Towards evening a slight chilliness comes on, towards morning per-

spiration supervenes. The febrile paroxysm is sometimes very slight, scarcely attracting notice, sometimes severe, causing unpleasant sensations, and exciting alarm. Sleep ceases to refresh, food to give strength and vigor. The aspect of the patient changes; the countenance is pale, expressive of languor or red with the hectic flush. The skin is less elastic, the muscles less firm, menstruation is tardy or entirely wanting; emaciation becomes evident. If these symptoms have appeared in the spring time, by the use of proper remedies, and regimen, they are almost entirely removed, until the returning autumn and winter, bring them on with increasing severity. Occasionally they seem to arise from bronchitis, pleuritis, pneumonitis or some febrile disease. When they succeed to measles or scarlet fever, they frequently progress with unwonted rapidity.

The rational symptoms, are subject to much variation. In most cases, however, a short dry cough is one of the first symptoms that excites alarm. Often very slight, a mere hacking in the morning, it steadily increases, and at length, is accompanied with an expectoration of frothy, transparent mucus, and afterwards of yellow, opaque matter. Slight dyspnœa occurs when the patient exercises. About the sides and shoulders there are fugitive pains. Slight hemorrhage from the lungs occurs; at times, it may be somewhat copious, but often small in quantity. As the disease progresses, the cough increases, preventing sleep, and sometimes occurring in paroxysms. The expectoration is correspondingly increased, becoming thicker, more yellowish, or greenish, and purulent. The other symptoms usually advance with equal pace. Sometimes, the disease is very insidious in its approach. Suddenly without any premonition, a violent attack of hæmoptysis occurs, immediately succeeded by all the appearances of confirmed phthisis. These rational symptoms are intimately connected with the tubercular deposition. The tubercles are in a state of crudity. Softening has not yet commenced. They are in the form of small, roundish homogeneous bodies, collected in clusters, or more widely disseminated through the lungs in the form of miliary tubercles. Sometimes they are more or less firm, of a grayish color, or translucent.

When closely collected together, they cause a consolidation of

the pulmonary tissue which gives rise to obstruction to the ingress and egress of air and to the pulmonary circulation. Hence the shortness of breath, and the occasional emphysema, that sometimes occur. Other effects resulting from a consolidation of portions of the lung by the deposition of tubercles, are sanguineous congestion, œdema, gangrene, hæmoptysis and effusions into the pleura. Hæmoptysis in the early stage of consumption is generally from this cause, and it is a serious symptom, not only because it may endanger life by the loss of blood, or by suffocation, but because it is accompanied by hemorrhagic consolidation, and rupture of pulmonary tissue.

Physical Signs.—In the nascent state of phthisis, we cannot derive positive information from physical exploration. In order to produce abnormal sounds on percussion and auscultation, the deposit of tubercles must be considerable, or there must be in some one part of the lungs,—be it ever so limited,—a deposit sufficiently great to interfere with the pulmonary functions. If the tubercles are small and scattered, the physical signs will not be so sure to detect the morbid change. If on the contrary they are large and clustered together, abnormal sounds will be the more readily developed. So that it is evident that the physical signs cannot determine the absolute amount of tuberculous deposition; since the arrangement of tubercles, as well as their number, has a modifying influence. Shall we therefore, conclude that the physical signs are of no practical utility? As well might we deny the usefulness of the telescope because it does not reveal all the minute phenomena of the heavens. Because no one of the physical signs is absolutely pathognomonic we should not conclude that their evidence, added to that afforded by the general symptoms, is not of great value. These signs found at the points most subject to tubercular disease, the comparative rarity of any other lesions capable of producing the same physical phenomena, enable us to arrive at a degree of probability which is almost equivalent to certainty. The existence of the two-fold evidence given by the general symptoms, and the physical signs, makes the diagnosis far more sure than it could be when founded only on one class of symptoms.

Inspection has been considered of some value in the diagnosis

of phthisis. An unusual immobility of those parts of the thorax adjacent to the location of tubercles, is mentioned by Andral, and again by Dr. Clark, as affording valuable evidence. Laennec never placed much dependence upon this symptom, nor does Louis regard it as of much importance.

Inspection is often a valuable means of diagnosis. Prominence of the clavicles, contraction of the intercostal spaces, a flatness of the chest in front, an unequal height of the shoulders, a depression of the ribs,—all these when present in a tuberculous patient, indicate the presence of phthisis.

Palpation is of no practical utility. In the last stages, a motion of the fluids in the bronchi, may sometimes be heard; but in the early stage, nothing definite should be inferred from this kind of physical exploration.

Percussion is usually somewhat dull in the early stage, under the clavicles. An inequality in its degree on opposite sides of the chest, and at points equally distant from the median line, adds much more significance to this physical sign, and especially if the dullness is greater on the left side. In emphysema and pneumothorax, a similar inequality of sound may exist. In these instances the diseased side is most sonorous, but the respiration is most feeble where the resonance is greatest,—a circumstance which distinguishes this condition from phthisis. An emphysematous condition of the lung occurring adjacent to the location of solidification from tubercles, may cause the percussion to remain nearly normal. Were this coincidence common, it would certainly diminish the value of percussion in diagnosis. But it is of very rare occurrence. The signs derived from percussion, should be sought about the clavicular and acromial regions. Obscurity of resonance being detected beneath one or both clavicles, or at any point of the chest near to the apices of the lungs, what conclusion should be formed as to the nature of the disease? To this question Chomel replies:—"Obscurity of sound and feeble respiration under one of the clavicles, give strong reason to suppose the existence of tubercles, for partial effusions take place in the immense majority of cases at the inferior and posterior parts of the chest, and it is almost never that chronic pneumonia is primitive and without the presence of tubercles."

In the early stage, the slightest difference of note or pitch on opposite sides of the chest, if confined to the clavicular and acromial regions, should excite suspicion. Although the dullness may be confined to a small locality over the top of the shoulder, and the scaleni muscles, yet if it be clearly perceptible it is a very sure indication of the existence of phthisis.

Auscultation in the first stage, reveals a feebleness of the respiratory murmur in the sub-clavicular region. This occurs where the percussion is dull, and at the same place the resonance of the voice is greater than normal. While in one part of the lung these signs are heard, in another, the respiration is *blowing*. A slight difference of sound in relative situations on both sides does not necessarily indicate phthisis. The anatomical relations of the lungs have a modifying effect. A sound in the right lung of a phthisical patient, should not be considered as indicative of tubercles, unless it is decidedly blowing. But if the respiration is more blowing at the apex of the left, than at that of the right lung, there can be but little doubt that tuberculous disease is present. With the advance of the disease, the respiration becomes somewhat rough or even bronchial, with a prolongation of the expiratory sound which is one of the most striking characteristics of tuberculous deposition. Inspiration is at times somewhat jerking. The cardiac pulsations are more audible than usual. Bronchial respiration and bronchophony are heard out of their natural locality; thus becoming indications of pulmonary lesion.

The hand applied to the sub-clavicular region, sometimes is able to feel an increased vibratory motion from the voice. In general these signs may be perceived over the upper portions of the scapulæ behind. These are indicative of solidification of the pulmonary tissues; and, when this condition of the lung is present beneath the sub-clavicular region, and, when, at the same time, there is no evidence of acute pneumonitis, the probability is very strong that it is caused by tubercles.

Second stage.—The second stage of phthisis may be considered, as beginning with the softening of tubercles, and terminating when cavities are fully formed, and all the physical effects arising from them, are fully developed. In other words it is the formative stage of vomicæ.

The circumstance which has been considered, as marking the passage from the first to the second stage of phthisis, is a remarkable change in expectoration.

General symptoms.—In the second stage, the general symptoms for the most part, are the same as those in the first, differing mostly in degree, and not in kind. That there is an arbitrary line of division between the different stages, is an erroneous idea. And we should, therefore, consider the various changes occurring in the progress of phthisis, as but a continuous chain of abnormal phenomena,—a chain the links of which cannot, and should not be considered as separated by any division made for the sake of convenience in description.

Of the general symptoms collectively, I remark that they are more severe. The evening chills are more constant and troublesome, the succeeding heat is more intense, and more general, the morning sweats, more regular and copious. Hectic is more constant, and, in the words of another, "hangs out upon the cheek the red flag of death;" the pulse is more frequent, the respiration quick and laborious even when the patient is at rest. Languor and weakness increase, emaciation is rapid, the muscles are soft and flabby, and the patient can no longer endure his wonted amount of mental or physical exertion. Paleness of the countenance frequently remains during the early part of the day. Sometimes there is a greater tendency to chills shown by an increased sensibility to cold, and the evening exacerbation brings on an increased heat of the palms of the hands and soles of the feet. The countenance, under the influence of the morbid excitement, is for a while more animated, the eye brightens, and the red blush of hectic gives to the features new beauty and loveliness. When speaking, the lips of the patient slightly quiver, there is a breathlessness which interrupts him in the middle of a sentence. Sleep is more disturbed. Not unfrequently the mind, even in this stage of the disease, is buoyant and hopeful. The least and most temporary amendment in his symptoms, or the delusive promises and boasts of quacks, inspire him with the joy of hope.

Special symptoms.—At the beginning of this stage, a change is observed in the expectoration. The frothy, colorless sputa which had before attended the cough, now contain small specks of opaque

matter of a pale yellowish color, that gradually increase forming patches, surrounded by the transparent portion in which they seem to float. Streaks or specks of blood are also seen in the expectoration. With this change, the other rational symptoms increase, the cough becomes more harrassing, and respiration is hurried. Hæmoptysis is likewise a frequent occurrence, amounting sometimes to a slight streak of blood in the expectoration, at other times, to a considerable quantity. Darting pains are frequent around the chest—the result of pleuritic inflammation excited by the extension of the tubercular disease to the pleura. These are, therefore, usually confined to that part of the lung in which the tuberculous disease is most developed.

The *Physical signs* in this stage are more marked. As the disease advances, the tubercles soften, and become diluted with a morbid secretion from the pulmonary tissues. Particles of curdy or cheesy matter, pass from their locality in the parenchyma of the lungs, into the bronchial tubes and are expectorated. The exit of this matter from the lungs, gives rise to the formation of little vacuities, called caverns, cavities, vomicæ, or excavations.

A careful examination of the chest, at this time, affords positive evidence of the internal mischief. The upper parts are less freely raised, during respiration than in the healthy state; this phenomenon frequently being more evident on one side than on the other. The sub-clavicular regions on both sides, give a dull sound on percussion. To the mind, the ear, or stethoscope, when applied to those portions of the chest situated where percussion is dull, reveals a slight crackling noise—the crepitating ronchus.

After vomicæ are formed, the cavernous rale or the gurgling is heard, when the cavity is partly filled with liquid. Resonance of the voice and cough, and at length pectoriloquy follow.

If a solidified portion of lung, enclosing a considerable bronchus, comes near to the surface of the chest, then bronchial breathing and bronchophony will be audible. Percussion, too, will give the same sound, whether the lung be hepatized or blocked up by tubercular matter. This condition of the lungs may be present in one part, while cavities exist in another, and therefore, different parts of the chest will present different physical signs. I have said that the gurgling sound is heard in case the vomica contains

liquid. But does this sound necessarily prove in all cases, the existence of cavities? Dr. Watson remarks "that where we hear during inspiration or coughing, the gurgling rale,—called by Laennec gargouillement—we may conclude, that there exists a cavity. But the cavity will not necessarily be a vomica. In ninety-nine cases out of a hundred, it will be so; but in the hundredth case, perhaps it will not." Dilatation of the bronchi, sometimes produces a considerable globular expansion. In case these cavities, formed by such an expansion were filled with a liquid, the same sound would be produced, as that caused by the tubercular vomica.

Another morbid condition of the lung might cause the same sound, and that is an abscess formed by inflammation. When the cavity is empty, cavernous respiration would be heard. The size of the vomica will modify the nature of the sound. When very small it may be and often is "a mere click, like the opening and shutting of a valve, or a chirp, or a creaking." By Dr. Watson, all these modified sounds, are called by the same name,—cavernous respiration.

The voice is generally more resonant than usual, amounting, in some cases, to bronchophony. Distinct pectoriloquy is sometimes heard in one or more points of the clavicular and scapular regions. These indications are very generally more evident on one side, than on the other, and hence the necessity of attending to this circumstance, in order to form a correct diagnosis.

The length of time during which a person may continue in this state, varies in a great degree. In some cases, a few weeks bring him to the brink of the grave; in others many months and even years may pass away without any apparent increase of the symptoms.

Third stage. The third stage is that period which, commencing when cavities are *already formed*, and all their attending phenomena developed, continues until the termination of the disease. This has been called the *colliquative stage*, from the copious perspiration, the frequent attacks of diarrhœa, and the abundant expectoration with which it is attended. The feet and ankles become œdematous, the vital powers gradually decrease, one after another, the functions of life fail; the body by a *facilis descensus*, falls to the earth and the soul rises to eternity.

General symptoms.—The most important of these are the colliquative sweats, the diarrhœa, extreme emaciation, anasarcous swelling of the lower limbs and high febrile excitement. A sure forerunner of approaching dissolution is an apthous condition of the mouth. This usually comes on during the last weeks, or days of existence.

The mental faculties, at this period of phthisis, are more or less deranged. Reason remains, but it is not the reason of health. Slight delirium sometimes occurs; the patient becomes indifferent to what is passing around him and to his own state, when a little while before, his attention was aroused by every unfavorable symptom.

Special symptoms.—The expectoration is very copious, consisting of a heterogeneous mass of mucus, pus, softened and occasionally solid tubercle, blood, shreds of lymph, rarely portions of pulmonary tissue; sometimes very fetid. The cough and dyspnœa increase. The shoulders are raised and brought forward; the chest is narrow and flat. During respiration, the clavicular regions are less movable than natural, and when the patient attempts to make a full inspiration, the upper part of the thorax, instead of expanding with the appearance of spontaneous ease peculiar to the healthy state of the lungs, seems to be forcibly dragged up at each respiratory effort. Perforation is most frequent on the left side. Louis found it on that side in seven cases out of eight.

There is an accident which tends to ruffle and hasten the course even of the quietest forms of consumptive disease; this is perforation of the pleura, and the consequent pneumothorax and acute pleuritis which it produces. This lesion is already described. But it may perhaps be well to point out the sudden dyspnœa and accession of sharp pleuritic pain, occasioned by this morbid accident. This occurs more frequently in males than in females. Dr. Williams says, "that he never has seen one instance of this lesion in the female, while he has seen at least, twenty cases in the male sex. The place where it usually takes place, is the lower and back part of the upper lobe of the lung, opposite the angle of the third or fourth rib, that is, just beneath the false membrane, by which the summit of the lung is generally adherent.

Physical signs.—The physical signs in the third stage, are similar to those of the second. The gurgling rale, the increased resonance of voice, bronchophony, and pectoriloquy, amphoric resonance and metallic tinkling, may be present in different cases, and at different times. Some of these signs are more frequently heard than others. The metallic tinkling is oftener present in a large than in a small cavity, and since large cavities are formed in the third stage, this symptom is observed only when the disease is far advanced.

But what are we to infer from the presence of metallic tinkling? A cavity must exist, and liquid be present in it. This condition exists in pneumothorax. How can we distinguish the metallic tinkling of tubercular cavities from that arising from liquids in the pleural sac? 1st.—By the location. In phthisis, the largest cavities are usually at the apices of the lungs. In pneumothorax the cavity is towards the sides of the chest, and the sound is heard nearer the lower part of the thorax. 2nd.—By the absence of resonance. When the pleural sac is filled with air, the sound on percussion is drum-like, there is a remarkable resonance. But over tubercular cavities, percussion is dull, and the cause giving rise to that dullness, is the induration of the layer of lung between the internal surface of the chest and the cavity.

The amphoric respiration, too, is another symptom which requires for its production a large vomica, with hardened and smooth walls. This then, on account of the nature of the physical lesions, must be most frequent in this stage. Another lesion may give rise to its production. It is a perforation of the pleura, in which case the amphoric tone is extremely well marked, or the cavity is much larger than one formed in the lungs, and its walls are large and elastic. Its different location and distinctness, together with the other symptoms of pneumothorax, will prevent a wrong diagnosis.

Pectoriloquy also more frequently occurs in this stage of the disease than in any other. A cavity most generally gives rise to cavernous respiration in breathing, and to pectoriloquy in speaking. But this modification of the healthy sound of the voice, should not be considered as pathognomonic of the existence of a cavity. Solidification of the lung around the larger ramifica-

tions of the bronchial tubes, may give rise to the same sound of voice. Of the relative value of this physical sign, Dr. Stokes observes "that alone it is of little or no value. Cavernous respiration is far more alarming. Whenever actual pectoriloquy from a cavity is heard, there also will be heard cavernous respiration. But the converse of this is not necessarily true. There may be, and there often is, cavernous respiration, and a cavity, and yet no pectoriloquy. The cavity is not large enough, or not near enough to the surface of the chest, or not of such a kind as to reverberate the voice.

"Often when pectoriloquy is absent, and cavernous respiration is doubtful, and gurgling even cannot be heard—because the communication with the bronchi is not free,—a slight splashing sound will occur, when the patient coughs; nay, we may sometimes hear it, as he holds his breath, with every beat of the heart, which causes a little succussion in the cavity; but its contents must then be thin." [Watson.]

When these sounds are present, what may we infer? In all cases the existence of a cavity is indicated, but is that cavity necessarily a tuberculous vomica? Not always. A cavity formed by pulmonary abcess, or by dilatation of the bronchi, may give rise to the same physical signs. This latter condition is deceptive, but it seldom occurs. Dr. Watson's advice, in such cases, is appropriate. "When the sounds are not well marked take time before you pronounce a decided opinion respecting them. Strong bronchophony comes very near to weak pectoriloquy: bronchial respiration may closely resemble some varieties of cavernous breathing: large crepitation confined to a small spot, may similate gurgling. It is better, when the sounds are thus equivocal, and when they may denote conditions so very different in their nature and tendency, to suspend one's judgment, and to give a guarded opinion. A little time in such cases will clear away the doubt."

Particular consideration of the General and Rational Symptoms.

1. *Cough.* This is the first symptom which claims our attention, being in most cases the first that causes alarm. It is often slight and dry, occurring chiefly in the morning when the patient rises from his bed, or during the day, when he makes any uncom-

mon exertion. In this state it is scarcely noticed. To the patient it appears to be of no consequence. But its increase soon becomes evident. In some cases it is slight, in others, severe. In some rare instances it appears only a few days before death. Louis gives two cases of this; and Portal affirms that the disease can exist without the slightest cough. In general it is most common at night, in the morning, or soon after meals.

Catarrhal cough simulates that arising from tubercular disease. In general, however, it may be easily recognised. The catarrhal is deep, implicating the respiratory muscles, attended with soreness of the chest, frontal headache, and other symptoms of catarrh. It is soon followed by expectoration, at first colorless, but soon becoming opaque, then assuming a yellowish mucous character. From this time the cough and expectoration begin to diminish, and under ordinary circumstances soon cease. When the catarrhal disease assumes a chronic form, more difficulty will be found in learning its true character. In case the patient before the catarrhal symptoms come on, has been subject to dyspœna or hæmoptysis, tubercular disease should be strongly suspected.

Another kind of cough which in some respects simulates that of phthisis, is one which has been called *stomach cough.* It arises from gastric irritation. In general it is louder and harder than the phthisical cough, and frequently comes on in paroxysms or fits. The sensation which excites it is felt deep in the epigastric region, and the irritated state of the stomach, is manifested by the ordinary symptoms of gastric derangement. In some cases this is complicated with phthisical cough, in which case means should be used to remove the gastric derangement. Symptomatic cough may arise from other causes. Disease of the heart, irritation of the liver and duodenum, intestinal worms, and disease of the uterus often give rise to this symptom. The cough which is present in chlorotic females may generally be distinguished from the phthisical cough by the other symptoms, and by the effect of remedies; those means which relieve the former, having no lasting effect upon the latter.

Another variety of cough is the *nervous.* This is produced by excitement, has a peculiarly sharp, barking sound, repeated in quick succession, and often continues an hour without intermission. It is frequently the effect of hysteria.

Expectoration.—The expectoration, in cases of suspected phthisis, has attracted much attention.

It was thought if a patient spit pus, he was in a state of confirmed consumption. This opinion, however, has now become obsolete, and few physicians now base a diagnosis upon this symptom alone. Various tests have been discovered in order to detect its presence in the sputa. Pus globules when examined through transmitted light, will exhibit prismatic colors, while mucus affords no such appearance. The liquor potassæ liquifies mucus, but converts pus into a viscid, stringy mass. The sputa come from the bronchi, composed of mucus and yellow or greenish matter. From disease of the trachea and bronchial tubes, a purulent or muco-purulent discharge often takes place. And hence the presence of pus, in the expectoration, does not necessarily indicate the formation of tubercular cavities, or even the softening of tubercles. Sometimes the sputa appear in the form of globular flocculent masses, resembling little portions of wool.

Dr. James Clark, divides the sputa into two varieties; the first, he terms the striated state of the expectorated mass, with a mixture of whitish fragments in it; the second, the ash-colored globular masses which are observed in the more advanced stage of the disease.

When spit into a vessel, the masses composed of the latter kind mentioned by Dr. Clark, assume a flattened round appearance; they are adhesive, and, from their resemblance to a piece of money, are called by the French *nummular*.

Each sputum in general preserves a distinct form, so that the number of expectorations may be known by counting the number of sputa.

This is not perfectly pathognomonic, but is nearly so. Louis saw two cases in which this kind of sputa was found without any connection with tuberculous disease. Chomel had one case of a similar character. In the latter stage of phthisis it is sometimes fetid, and, more than other kinds of expectoration, attracts flies.

The quantity of the expectoration varies remarkably in different cases, and is by no means to be considered commensurate to the extent of pulmonary disease. Sometimes the quantity is very

small, although after death large excavations are found. This may arise from a cavity around which inflammation has so completely blocked up the larger vessels, even the ramifications of the bronchi, as to entirely prevent any communication of the cavity with the external air. A case of such a character recently came under my observation. In the right lung around the ramifications of the bronchi, was a very large cavity, filled with muco-purulent matter, but not communicating with the bronchi. No expectoration, at least, not enough to call the attention of attendants, existed during the progress of the disease. Dr. Portal likewise speaks of similar instances.

When tubercles are crude the expectoration comes from the bronchial membrane. Later in the disease it comes mostly from the bronchial membrane, but partly from the softened tuberculous deposits. The surface of cavities affords an additional amount of morbid secretion. The quantity generated from this source is sometimes great, but often it is extremely small. In reviewing the facts already stated concerning the expectoration, its variations in quantity, in appearance, and the various lesions from which it originates, we may safely draw the conclusion, that, unless combined with other symptoms, it cannot, especially in the early stage of phthisis, be considered of very great utility in forming a correct diagnosis. Later in the disease, in conjunction with other symptoms, it has value in enabling us to ascertain the presence of tubercles, and the changes which occur in the course of their development.

Dyspnœa.—This symptom varies greatly in the degree of its intensity in different cases. In some instances it occurs early in the disease, being among the first phenomena which attract the patient's attention; and it is one of the most constant and remarkable symptoms in that form of the disease, called *Febrile Phthisis.* More frequently it is not troublesome until the malady is far advanced, and it generally becomes very distressing in the last stages. When the tuberculous disease makes slow progress, the dyspnœa is seldom great; and, in persons who, from their quiet mode of living, use little exercise, it is scarcely noticed, even when the respiration is more than double its usual frequency. In such cases the oppression in breathing experienced during mo-

tion, is very often attributed to debility. Indeed, it is by no means an unfrequent occurrence, to find the patient unwilling to admit the existence of such dyspnœa until minutely questioned on the subject.

Although we shall not err far in stating that the degree of dyspnœa, or hurried respiration, will generally be found proportionate to the rapid progress and extent of the tuberculous disease of the lungs, still this will not always be an invariable occurrence. We are not yet acquainted with all the causes of dyspnœa.

Of one hundred and twenty-three cases reported by Louis, three only presented examples of severe dyspnœa, and a careful examination of the whole contents of the thorax after death, detected nothing to explain it. A degree of congestion of the lungs commonly exists in persons of a tuberculous constitution, both before and after the formation of tubercles. This may be one cause of dyspnœa; and hence we frequently find that an attack of hæmoptysis relieves the dyspnœa for a considerable time. On the other hand it not unfrequently happens that the origin of the difficult breathing is dated from an attack of hæmoptysis.

Dyspnœa, although not much to be relied upon as an indication of phthisis, is frequently present, and should always be a subject of inquiry. It is chiefly during exertion that the oppression of breathing is experienced, and as it differs little from that which in a slight degree always accompanies such exertion, it seldom attracts attention. It occurs most frequently when sudden and large deposits are made, or when there is tuberculous infiltration. Congestion, accumulations of mucus in the bronchi, pneumothorax, extensive pleuritic adhesions, so binding down the lungs to the parietes of the thorax as to prevent their normal expansion, are among its causes.

Hæmoptysis.—This is the most important rational symptom which occurs in phthisis. In other diseases and conditions of the lungs it is so rare, that it very certainly indicates the nature of the case. Hæmoptysis, to be sure may be produced by other causes; by certain forms of heart disease, by cancer, by cirrhosis of the lungs, and, in females, by vicarious menstruation. But these latter conditions of the lungs are very rare, and, therefore,

hæmoptysis should always be considered a strong evidence of the existence of phthisis.

Sometimes it occurs very early in the disease, often it is the first symptom. The quantity of blood expectorated varies greatly in different cases. When it exceeds two or three ounces it may be called a free hemorrhage. When less than this, it is moderate. Profuse hemorrhage often excites gagging, and causes some of the symptoms of hæmatemesis. From the latter, the pulmonary hemorrhage may be distinguished by waiting until it has nearly ceased, when the coughing will indicate that the blood is expectorated. Not unfrequently the blood seems to come from the throat, and the patient very often is inclined to refer its source to that locality; and hence the physician should seldom rely upon his statement in forming his diagnosis.

The hemorrhage need not be copious in order to be indicative of danger. A teaspoonful of blood, mixed with a little mucus may be occasionally expectorated without pain or effort. But little anxiety is excited on the part of the patient, and yet when repeated it is quite as diagnostic of phthisis as a more copious discharge.

"Hemorrhage, although so important as a diagnostic sign of tubercles, very seldom proves fatal by its immediate effects; neither does it seem, as a general rule, to act unfavorably on the general progress of the disease. On the contrary, statistical tables prove, that those phthisical patients who experience hemorrhage, usually live longer than those who do not. Oftentimes the flow of blood is attended with a feeling of decided relief, especially if it assumes the character of a passive hemorrhage. Sometimes, when it assumes an active character, attended with febrile excitement, and induces a condition of lung analogous to inflammation, it may produce injurious effects—an active period in the progress of the disease seeming to coincide with its occurrence. Thus hemorrhage is not always to be regarded in the same light, when you look at individual cases. But when you look at this symptom in the mass of cases, its existence must be regarded as exerting rather a beneficial influence than otherwise. There are many persons, more or less tuberculous, who, from time to time, expectorate even large quantities of blood, who after a little rest, to recruit

the exhausted strength, return to their occupations, and live on, year after year, without any apparent loss of health. The most protracted case of phthisis I have ever known, lasting thirty-five years, was marked by occasional returns of, sometimes, very copious hemorrhage during this long period.

"I have stated to you that hemorrhage from the lungs did not mark the stage of the disease. It may occur early or late in its progress. Formerly, hemorrhages were attributed to two causes, exhalation from a free surface, as the mucous membrane, or rupture of a blood-vessel. But microscopic observations have established the fact that there can be no such thing as an exhalation of blood, it must always escape from a ruptured vessel. It may take place from numerous capillary vessels ramifying upon the surface of the bronchial mucous membrane, and this is probably the fact in a great majority of the cases of hemorrhage connected with tubercles—always indeed, when it occurs at an early stage of the disease. Its mechanism is simply this:—The tuberculous deposit, by pressing upon the capillary vessels of the lungs, obstructs some of them, while others become congested in consequence. These congested vessels, when seated in a mucous tissue, become ruptured from distension, and discharge blood. There is no reason to believe that the capillaries of the air-cells or of the common cellular tissue of the lungs are ruptured. If they were ruptured, you should find pulmonary apoplexy in fatal cases. But this is not the case. Hemorrhage may, indeed, occur from a ruptured vessel of considerable size, from ulceration. This can only happen in an advanced stage of the disease; even then it rarely occurs from this cause. When it does occur, it is usually very abundant and difficult to control.

"When patients are questioned as to what may have excited the hemorrhage, they can seldom state any thing which seems likely to have acted as an exciting cause. In a large proportion of cases it occurs quite unexpectedly, without premonitory symptoms. Sometimes an unusual effort, especially of the chest, seems to act as an exciting cause; and in women, the occurrence of the menstrual period may induce the same result.

"Hemorrhage would undoubtedly occur more frequently and copiously than it does in the progress of phthisis, and as the lungs

become filled with the tuberculous deposit, was it not that the quantity of blood circulating in the lungs is materially diminished. The blood emaciates like the other parts of the human system. This influence is felt also by the heart, which does not increase in size with the progress of the pulmonary obstruction, as you might suppose, but it rather diminishes in size, with the diminished quantity of blood in the circulation.

"I am not afraid that I have dwelt too long on this important symptom. Its frequency, its diagnostic value, its influence on the prognosis, the great alarm it usually excites in the patient, and in the family, make it worthy of the most careful consideration." [Dr. Swett's Lectures.]

Pain.—In the early stage of phthisis, this is seldom very severe, and in some cases is not sufficiently so to excite attention. Usually there are flying pains through the shoulders and sides. Their source probably is the external intercostal nerves. In many respects they may resemble rheumatic pains. But their history and their complication with other symptoms, will easily distinguish them. Another source of pain is inflammation of the pleura, arising from the extension of the pulmonary disease to that membrane. This is more local than the former; and from the ordinary locality of the pathological changes by which it is produced, we know, that it should be confined to the sub-clavicular or adjacent regions. In general its locality points out the place where the tuberculous disease is most early developed. Combined with other symptoms, it is of some value. As the disease advances, the pain increases. When confined to the lower part of the chest, and to the epigastric region, it frequently arises from inflammation of the pleura of the diaphragm, and, therefore, cannot be a valuable diagnostic sign of phthisis. The pain caused by catarrh, differs from that caused by phthisis. That arising from the former disease is more confined to the sternal region,—being a sensation of soreness rather than of acute pain, extending through the chest to the spine. At first, the *decubitus* is on the most healthy side. Late in the disease, it is often the reverse; and for this reason:—When the patient lies on the diseased side, the matter collects in the vomicæ, and does not pass into the bronchial tubes and excite

coughing. Severe pain, and dyspnœa, coming on suddenly, are indicative of that important lesion—the perforation of the pleura.

Constitutional symptoms.—The state of the pulse is a symptom which has attracted much attention. Its real value in diagnosis has been overestimated. An opinion is too prevalent that the lungs are safe when the pulse does not rise above its normal standard. Sometimes it remains steady nearly up to the period of dissolution. In such cases, the disease progresses slowly. Dr. Watson relates a case in which the pulse never rose above sixty-eight beats in a minute. More commonly, however, the pulse is habitually above ninety; and often much quicker. Whenever it is so, and for its increase in frequency no other cause save tubercular deposition can be assigned, it is a suspicious symptom.

In the early stage, the excitablity of the pulse is often a striking characteristic. When the patient is tranquil, the pulse is tranquil, but the least excitement carries it up ten or twenty strokes in a minute. When the disease has taken a strong hold, the pulse indicates it. It is permanently and decidedly accelerated with a sharp and quick stroke.

In the second stage it increases in frequency often rising to one hundred and thirty beats in a minute. A slow pulse is a good omen in tuberculous disease, inasmuch as it is usually associated with a condition of the system favorable to recovery.

Fever.—In the incipient stage, this is of an irritative character. Towards evening slight chills come on, which are followed by fever during the night. It increases insidiously, and at length terminates in morning perspiration. As the disease advances, the fever occurs in paroxysms, and the heat, instead of being confined to the hands and feet, is more generally diffused over the whole body. This latter kind of fever is the proper *hectic*, being caused by the softening of tubercles, and attended with frequent pulse not so hard as that which attends the irritative fever in the first stage.

Night sweats.—A marked symptom of hectic is nocturnal perspiration. This is not proportioned to the severity of the previous chill and fever. It has a close connection with sleep. Louis found the night sweats wanting in one-tenth of his cases. They are most copious about the time the diarrhœa appears. These

two symptoms—the diarrhœa and perspirations, have been considered supplementary. Of this, however, there is not good evidence. Louis found no reciprocal influence existing between them. At first they usually are confined to the head, neck and breast. Subsequently they extend over the body as the disease approaches its termination. "They are often very distressing, producing much discomfort and exhaustion upon the awakening of the patient. They evidently depend upon a debility of the capillaries, which allows the watery portions of the blood to pass without resistance; and they occur during sleep, because then the vital forces, and among them contractility are at their lowest ebb."

Emaciation.—This is one of the cardinal symptoms of phthisis. Frequently it precedes the other symptoms. Between the ages of forty and fifty, Dr. James Clark found it among the earliest symptoms of phthisis. Indigestion is regarded by the patient and his friends, as one of the principal causes of this atrophy. It is frequently associated with anæmia. There is many times a peculiar physiognomy, the cheek is pale and thin, and the eye bright. Every organ in the body, except the liver and heart, even the blood itself, emaciates. And this is often the first symptom noticed. At length, slight disturbance is manifest, a little dyspnœa, a little chillness towards evening, and a tendency to cough. This symptom, emaciation is not always progressive. The patient may gain flesh, but he soon loses it again; then perhaps gains awhile in weight, and so on alternately. This, however, is observable; the patient seldom gains as much flesh as he loses. There is a gradual though not continuous descent. It is true also that while there is an increase of weight, the tubercular disease in the lungs advances; and while the patient and friends are elated with hope by the apparent amendment, a fatal termination steadily approaches. Loss of appetite and diarrhœa very much increase the emaciation.

Diarrhœa.—The rapidity of the progress of consumption depends much upon this. With the number of evacuations, Louis found that the loss of strength and wasting corresponded. This fact should militate against the employment of cathartics in phthisis. "A tablespoonful of castor oil," says Dr. James Clark, "I have seen throw a phthisical patient into an alarming state of de-

bility." In those who have in health had a costive habit of body incipient phthisis produces regularity of the action of the bowels. Diarrhœa is usually confined to the advanced stages of the disease. In one eighth of the cases treated by Louis, diarrhœa commenced with the disease and continued until its termination; in the majority it occurred in the later stages, in others during the last days of life, and in four out of one hundred and twelve cases, it never appeared. The distress attending this symptom, is often severe. Before each evacuation, there is often a severe pain, and immediately after it a deadly sensation of sinking. It has an effect upon the cough and expectoration. The severity of these symptoms, is usually in the inverse ratio to that of the diarrhœa. As a diagnostic sign it is not of great value. The nature of the disease is known by other means, before this becomes fully developed. The cause of the diarrhœa, is the ulceration or the softening of the tuberculous matter deposited among the coats of the intestines. After death, we find ulceration of the mucous membrane, tuberculous deposits, thickening and softening, and enlarged mucous follicles, especially near the termination of the ileum and in the colon.

Œdema.—This is an invariable attendant of the last stage of phthisis. In young delicate females, it may supervene in the earlier stages. Generally it shows itself first in the lower extremities, and is for the most part confined to them. In the morning there is sometimes an œdematous appearance in the face. For diagnosis, this is of no value; but it is a prognostic of approaching death.

Cerebral and Nervous symptoms.—The intellect is usually unclouded. The mind when the disease is not complicated with any affection of the stómach and liver, is hopeful. The unwillingness of the patient to believe himself in danger, is one of the most remarkable symptoms of consumption. Even those who have a good knowledge of consumption, even physicians who have died of this disease, have exhibited the same peculiarities of mind. In the first stage there is a nervous irritability, a trembling of the hands, and the mind is in a peevish and irritable state.

Symptoms arising from derangement of the digestive and menstrual functions.—The symptoms of dyspepsia are not usually

very prominent. Very often the digestive functions are well performed until they fail from constitutional debility. The stomach secondarily becomes weakened, and the usual symptoms of indigestion supervene. In some rare cases the stomach seems to be primarily affected. Its mucous membrane, after death presents a "thickened, mammillated, softened" appearance, indicative of the existence of chronic inflammation. At times, the gastric symptoms become severe. Extreme tenderness over the epigastrium, vomiting of bile and mucus, and a burning sensation occur.

Sexual symptoms.—In male patients nothing remarkable occurs in connection with the sexual functions. In females it is far otherwise. The occurrence of pregnancy arrests for awhile the development of tubercles; lactation also exercises a favorable influence over it. During gestation the most alarming symptoms of phthisis often disappear; and it sometimes happens in young married women, that the disease is warded off, many years by child bearing and nursing; and sometimes even the predisposition seems to be overcome. After delivery, in most cases, its return is speedy, and it appears to compensate in the rapidity of its march, for the time during which its progress was arrested. It is probable that while pregnancy arrests the progress of phthisis, it only renders it latent, and thus a mere temporary and not a permanent advantage is gained. Sometimes there is good evidence to believe, that it does not produce much temporary benefit, and the practitioner who recommends it to his patient, may be disappointed in its effect. "Even supposing that the progress of tubercles is retarded during the existence of pregnancy—what is the final result? As soon as delivery has taken place, the pulmonary disease usually advances with great rapidity, and, in addition, a child with a strong tuberculous tendency is born. Certainly there is no great advantage in these results, and you will, I hope, be disposed to adopt the opinion that I have formed,—never to advise pregnancy to a tuberculous patient. Cases of this kind will occur often enough, and the evil consequences be experienced, without, or in opposition to your advice." [Swett's Lectures, p. 263.]

The condition of the menstrual function in females, is a consideration of much importance. Many young females cease to menstruate, they become pale and feeble, they emaciate somewhat,

and the whole attention is directed to the cessation of this menstrual function. This abnormal condition, is supposed to demand for its removal, active emmenagogues, which are uselessly prescribed. The desired effect is not obtained, and the symptoms of phthisis are gradually developed.

Some diversity of opinion now exists in regard to the influence of gestation in arresting the progress of phthisis. "But independently of the general belief," remarks Dr. Wood, "my own personal observation has been such as to render it impossible for me to have any doubt on the subject. I have repeatedly seen the disease, even in its somewhat advanced stages, apparently quite arrested on the occurrence of pregnancy. Two cases are prominent in my recollection. The patients were admitted into the Pennsylvania Hospital, with cavities in their lungs, and all the symptoms of decided phthisis. After a time they began to improve wonderfully, and unaccountably. The general symptoms vanished almost entirely, and they became fat and quite healthy in appearance. This change was found to be coincident with the occurrence of pregnancy."

Is the suppression of the menses the cause of the tubercular disease? Some have thought that it might lead to the deposit of tubercles in the lungs. The menstrual suppression, is for the most part, the effect of that general debility, that deficiency of the nutritive properties of the blood, which precedes the deposition of tubercles. If this theory is true, then the treatment, instead of being wholly directed to the restoration of the uterine function, should be directed to the removal of that deficient nutrition, and its consequent debility which cause the menstrual suppression, and the tuberculous deposition. The cessation of the menses is sometimes one of the first, if not the first prominent symptom of phthisis, and a careful examination of the case will often discover this to be the fact. Attendant upon this symptom, there are, in most cases, a slight cough, a little chilliness and fever, and some of the physical signs of incipient phthisis. In general, this function continues, but decreases in quantity, during the early stage of the disease. At a later period, about the time when tubercles begin to soften, it sometimes ceases abruptly. There are cases in which the menses continue during the whole progress of the dis-

ease. From a great variety of causes, this function is so liable to derangement, that as a diagnostic sign it is not of much value.

Duration of Phthisis.—Tuberculous phthisis is essentially a chronic disease, the range of its duration being considerable. Cases have been recorded, which have terminated in eleven days, while others have lingered for twenty and even forty years. These, however, are extreme cases. The majority of cases terminate in one or two years, the average duration being eighteen months. Various circumstances modify its duration, such as age, sex, the constitution of the patient, the climate, season of the year, &c. Louis found the mortality greater among females during the first year than among males, in the proportion of forty-two to thirty. After that time the ratio was the same in both sexes. When patients have all the advantages derivable from proper regimen, change of air, and good medical treatment, the medium duration of phthisis is probably not much short of three years.

Section III.

VARIETIES OF PHTHISIS.

Although tubercular disease is essentially the same, in its anatomical characteristics, and constitutional origin, it varies greatly in the duration of its course, and in the external features which it assumes. Five forms of phthisis, differing from the ordinary form of the disease, are described by Sir James Clark. I propose to consider the *acute*, the *chronic*, the *phthisis* of *children*, and the *latent*.

Acute Phthisis.—The usual duration of phthisis has been stated to be about eighteen months. In the present variety, it frequently runs its course in two or three months, and sometimes in a still shorter period. The acute form, admits of a useful division into two varieties: The *first* variety, in which the short duration of the disease depends chiefly on its violence. The *second* variety, in which the feeble powers of the constitution sink under the pulmonary disease, long before it has reached that stage at which it generally proves fatal.

The *former* variety, is manifested by symptoms which, from their onset, are usually severe;—the pulse is quick, the heat of the skin considerable, and the patient at an early period of the disease, is confined to his bed. All the symptoms of phthisis succeed each other with great rapidity. The cough increases, expectoration goes quickly through its various changes, hectic fever is violent, the morning perspirations copious, and diarrhœa hastens on the patient to the termination of life; and in six or eight weeks he dies of what is expressively called by the public, "a *galloping consumption.*" Of this variety, young people are usually the subjects. It frequently comes on soon after the cessation of some acute exanthematous disease, as scarlatina and rubeola.

This variety, in general, occurs in those persons whose constitutions are so highly tuberculous, that any slight cause, easily excites a deposition of tubercles in the lungs.

In other cases, the tuberculous deposits exist in the pulmonary tissue, anterior to the development of any external manifest symptoms. The disease is latent, and an attack of hæmoptysis, or of catarrh, produces pulmonary congestion. Generally some inflammation in some part of the lungs follows, complicating the tuberculous disease. Henceforth the disease puts on its usual symptoms, and rapidly passes through its course.

The *latter* variety is observed most frequently in delicate young persons, and according to Dr. Clark, more frequently in females than in males. Their highest degree of health is below the ordinary standard. Possessing the tuberculous cachexia they are habitually weak, easily fatigued, and have a feeble circulation of the blood. The symptoms in such, are not violent, the real condition of the patient is somewhat concealed, and, before suspicion in respect to the disease is excited, the tuberculous lesion is far advanced. Debility is considered the cause of the accompanying symptoms. The breathing is quick, cough troublesome, and the expectoration sometimes tinged with blood. The pulse becomes rapid, and the morning perspiration copious. The countenance is pale and of a leaden hue, the lips are of a bluish color, and the albuginea, of a slightly dull, pearly tint. Without much apparent increase in symptoms, such patients sometimes sink rapidly under

an attack of diarrhœa, producing such extreme syncope as to terminate life.

Chronic Phthisis.—Laennec and Bayle first described the nature of this variety of phthisis. They showed its identity with the other forms of the disease. The acute form, as I have mentioned, occurs, for the most part, in the young. The chronic form occurs in the old. After the fortieth year it usually takes place. In the acute, the hereditary predisposition is strongly marked; in the chronic, scarcely apparent; or if so, it has been kept in check by a train of causes, adverse to tuberculous deposition. The disease, in most cases, is scarcely cognizable in the early stage. The patient may be a little languid, have a slight cough, attended by no fever or anorexy. He is a little dyspeptic, the stomach is the organ blamed for his indisposition. A visit into the country, change of air, and good food, dispel for a while, all appearances of the disease.

The next winter and spring, however, cause a return of the old symptoms. So the disease may alternately recede and advance, during a long period. But at last, after an attack of catarrh, it assumes more of the appearances of phthisis. Cough, dyspnœa, expectoration, emaciation and fever all arise, and threaten to terminate existence. From all these symptoms, sometimes he recovers, and during the summer months, enjoys a tolerable degree of health. In general, such patients while attending to business, are subject to occasional attacks of catarrh, pleuritis, or pneumonitis. Physical exploration of the chest will seldom fail to reveal the true condition of the lungs. The respiratory movements are more limited, percussion under the clavicles is dull, the voice more resonant than natural, and pectoriloquy is sometimes present. In such cases, cavities are formed, some of which have been emptied of their contents, others are in progress of cure, or are actually cicatrized. Regular and temperate habits may often cause the patient to live to the ordinary age of man.

Ordinary causes, those which would have either no effect or but a slight one upon the healthy constitution, give rise to the most serious diseases of the thorax. The influenza which prevailed in the summer of 1832, and spring of 1833, proved fatal to many such invalids. How can we account for this slow pro-

gress of the disease, when no exciting causes develop it, and its speedy termination when such causes exist? Evidently, the constitutional predisposition to such a disease is slowly induced by certain long-continued habits, and not by any hereditary influence.

That this view of the subject is true, seems to be evinced by the great prevalence of this form of phthisis among persons in the upper ranks of society. In those who labor, the acute forms are more prevalent. A form of phthisis somewhat chronic in its nature, is, however, occasionally observed in the lower ranks of society. One attack of pneumonitis, or pleuritis, or catarrh succeeds another, until the lungs become completely adherent to the parietes of the chest, the thorax scarcely moving during respiration. Post mortem examinations of those who die of this form of phthisis, reveal a variety of pathological changes, in one part inflammation has left its morbid products, in another tubercles in their various stages of development have disorganized the pulmonary tissues. This form of phthisis, from practical considerations, should be studied more than other varieties. In the first place, because it is liable to be overlooked until it has made considerable progress, and remedial agents have become comparatively ineffectual in its cure. And secondly, it demands thorough investigation, because, in this form more than in others, time is given for the operation of remedies, and for effecting its permanent removal by the formation of proper habits of life. The influence of its exciting causes, may be warded off, all derangements of the digestive organs, all irregularities of the circulation of the blood, can be removed before tubercles are deposited in the lungs.

Phthisis in Infancy and Childhood.—Phthisis is more common in childhood and infancy, than was once supposed. Dr. Guersent, one of the physicians to the Hospital des Enfans Malades',—an Institution appropriated to the treatment of patients between the ages of one and sixteen years—gives, as the result of his observations, that five-sixths of those who die in that establishment, are more or less tuberculous. [Le Blond, sur me espece de phthisie particuliere aux enfans. Paris, 1824.]

Early in life its existence is manifested by symptoms somewhat different from those of adults. The cough occurs in paroxysms;

hectic, expectoration and hemorrhage from the lungs, are not so apparent. The tuberculous cachexia, rapid pulse and breathing, emaciation and derangements of the digestive organs, tumid abdomen and irregular action of the bowels, at one time constipated, at another, affected with diarrhœa, and the pale unnatural color of the evacuations, point out to the physician, the nature of the disease.

In children, the mesenteric glands are more subject to disease than in adults. But the most frequent seat of tuberculous affections, is the bronchial glands, and next in frequency, the lungs. The relative frequency of tubercles in the bronchial glands of children compared with the lungs, is not less than five to four; which is of course more than reversed after the age of puberty.

The relative ratio existing between the frequency of tuberculous disease in the bronchial glands, lungs cervical and mesenteric glands is as the numbers 49. 38. 26. 25. [Journal de progress des sciences Medicales, t. ii. p. 93.]

Respecting the development of tubercles in the bronchial glands, Dr. Gerhard, says "it occurs nearly as in other solid structures of the body; scattered points of tuberculous substances are gradually deposited in the structure of the glands, surrounded by the original tissue, which remains for a considerable time nearly in the healthy state; sometimes, however, it is swollen and more vascular than usual, but more frequently it is quite pale, and infiltrated with the gelatinous substance which is in many cases the early stage of tuberculous matter. As the quantity of tubercle increases, that of glandular structure gradually becomes less, until the whole tissue of the gland is absorbed, and is replaced by tubercle. It is then much larger than the original gland, and the capsule which encloses it, gradually thickens, during the process of softening. After softening has followed, adhesion occurs between the glands and the nearest large bronchial tube, so that the contained matter is evacuated by an opening into it. In most instances, however, no softening occurs, but the tuberculous matter becomes hard and dry, and is converted into a calcareous substance, surrounded by a capsule. This substance often becomes extremely hard and solid, and generally remains in this state during life. The tuberculous disease of the bronchial gland, is, there-

fore, much less unfavorable than that of the lungs, and is essentially curable."

The symptoms of tubercles in the bronchial glands are very obscure. They can be recognized better by the existence of the tuberculous cachexia, than by any other means of diagnosis. Since this state of the system rarely exists in children without a deposition of tubercles in those glands, we may safely predict the existence of the local when the constitutional disease is present.

Respiration is extremely feeble in one or both lungs, while percussion is quite resonant. The only permanent sign is the feebleness of respiration, which is often caused by the contraction of the larger tubes in consequence of the pressure of the enlarged glands. Expiration is at times wheezing and protracted. The glands sometimes enlarge so as to produce a swelling on the sides of the trachea. This, however, is rare. In case the child expectorates tuberculous matter, and no symptoms of cavities in the lungs are present, the diagnosis is nearly certain.

Latent Phthisis.—Of phthisis there are cases in which the rational symptoms, such as cough, expectoration, hæmoptysis, pain and dyspnœa, do not exist. The development of tubercles is slow, it being from six months to two years before their existence is indicated by any local symptom. Out of one hundred and twelve cases of phthisis, Louis found eight in which the disease was latent. By closely examining the history of many cases of phthisis, we find satisfactory evidence, that tuberculous disease had commenced in the lungs from one to two years before proper attention was given to it, or its nature was understood.

The constitutional symptoms should excite the suspicion of the practitioner. Whenever these are present, without any visible cause, local disease must be their source of development. Under such circumstances, let an examination of the chest be made, and very probably the seat of the difficulty will be found in tuberculous disease. An attentive observer, will, in general, be able to detect it by the physical signs, by the general appearance of the patient, and by his peculiar diathesis.

But difficulties in diagnosis sometimes occur, which are not so readily overcome. The physical signs, as well as the rational symptoms, may be obscure, indistinct, or even absent. When

they are so, repeated examinations of the chest should be made. By so doing the true nature of the case will finally appear. This variety according to Dr. James Clark, is most frequently met with in the latter part of life, but it is not wholly confined to any period. Sometimes attacks of phthisis cease, the patient becomes comparatively well, and years elapse before any of its manifest symptoms again show themselves.

Laennec afflrms, "that the greater number of cases of phthisis are latent at the beginning, since nothing is more common than to find numerous miliary tubercles in lungs otherwise quite healthy, and in subjects who have never had any symptoms of consumption. On the other hand, from considering the great number of phthisical and other subjects in whom cicatrices are found in the summit of the lungs, it is more than probable that hardly any person is carried off by a first attack of phthisis. Since the adoption of this opinion on anatomical grounds, it has frequently appeared quite clear to me, from carefully comparing the history of my patients with the appearances on dissection, that the greater number of those first attacks are mistaken for slight colds, and that others are quite latent, being unaccompanied with either cough or expectoration, or indeed with any symptom sufficient to impress the memory of the patients themselves."

If this opinion of Laennec is true, it seems very important that the physician should be able to detect the disease in its nascent state. Were he able so to do, appropriate remedies could be immediately prescribed, the salutary effects of which would so fortify the system against repeated attacks, as to secure to the patient health and the enjoyments of life. If, then, we see a patient who, on the slightest exposure takes cold, who is thin, and pale, whose food affords but little nourishment on account of a deranged state of the digestive organs, whose form and temperament are favorable to the production of phthisis, latent consumption should be looked for, even though there are no rational symptoms manifested.

Certain conditions of the system disguise phthisis. Of these, one is pregnancy of which I have already written. An attack of mania is another condition which arrests the pulmonary disease. Dyspepsia sometimes draws off the attention from the phthisical

condition of the lungs. Diarrhœa is another disease which disguises phthisis. Not unfrequently when the intestines are supposed to be extensively diseased, on account of the presence of diarrhœa, a post-mortem examination reveals the existence of tubercles in the lungs. In such cases, the primary affection is generally in the lungs, the diarrhœa is for the most part secondary.

Section IV.

COMPLICATIONS.

Tubecular phthisis affects nearly every organ, but plays its most conspicuous part in the lungs. In them is its focus, and from them it seems to radiate. To this there are exceptions. But were we to consider the aggregate number of deaths from phthisis, whether occurring in childhood, during adolescence, in middle life or in old age, we should find that in a majority of instances, the lungs were primarily affected, and other organs secondarily. Other diseases so disguise its existence and so complicate with it, that, in order to arrive at perspicuity in diagnosis, it is necessary to consider the more important of those complications.

Cerebral Complications.—The phthisis of adults is usually attended with no great derangement of the cerebral functions. In children, however, it is different. The tuberculous meningitis of children is one of the most interesting lesions produced by tubercles. In them this form of cerebral disease is sometimes developed, antecedent to pulmonary derangements. It may be recognized by the severe pain in the head, followed by vomiting, prostration of strength, agitation alternating with stupor, convulsive movements, paralysis, and coma; and, by the termination of the case in death, while the thoracic symptoms seem to diminish. The tuberculous deposit is found, sometimes, in the pia-mater, at the base of the brain, and in its substance. Effusion of transparent, or turbid serum into the ventricles, is in some cases noticed. The disease called acute hydrocephalus, is the effect of the tuberculous disease, attacking the membranes of the brain; and chronic hydrocephalus, has probably an intimate connection with tubercular deposition in the cerebral substance.

Ulceration of the Epiglottis, of the Larynx and of the Trachea. —The epiglottis, in the latter periods of the disease, is frequently affected, and simultaneously with it, the larynx. The lingual surface of the epiglottis is rarely ulcerated. Louis mentions only one case of this kind. The symptoms by which it may be known, are pain in the region of the os hyoides, and difficult deglutition, fluids being ejected through the nostrils in the attempt to swallow. Sometimes there is œdema of the epiglottis. The larynx frequently ulcerates, the attending symptoms often being so prominent, as to lead the inexperienced to give a wrong location to the whole difficulty, and not to suspect any pulmonary disease. That variety of phthisis which is called laryngeal, is nothing more than pulmonary consumption accompanied by a morbid condition of the larynx, the symptoms of which predominate, and mask those of the pulmonary disease, upon which the emaciation, hectic fever, night-sweats, and other symptoms of phthisis chiefly depend. A constant symptom of ulceration of the larynx, is hoarseness, which often terminates in complete aphonia. The cough has a harsh grating sound, and sometimes resembles a kind of whistling.

The symptoms of ulceration of the trachea, are very obscure. Louis saw only one patient in which heat and obstruction, was complained of in the region of the sternum. Ulceration of the trachea is almost exclusively confined to phthisis, and the side of the trachea corresponding with the lung, in which the greater amount of disease exists, is most frequently and severely affected.

The bronchial membrane presents an abnormal appearance. It is reddened, thickened and sometimes ulcerated. This condition of the membrane is chiefly confined to the surface of those tubes which communicate with caverns. The sputa passing over the surfaces of the lining membranes of the bronchi, trachea and larynx, according to the opinion of Louis, cause the membranous disease.

These ulcers seldom penetrate below the mucous membrane, although they sometimes involve the muscular and cartilaginous rings of the trachea, the vocal cords, the arytenoid cartilages and epiglottis. That these lesions are closely connected with phthisis, is made evident by statistics. Out of one hundred and twen-

ty-two patients who died of chronic diseases, not phthisical, Louis found only one case of ulceration of the epiglottis and larynx; whereas, in those who died of phthisis, he found ulceration of the epiglottis and larynx in *one-fifth*, of the trachea, in *one-third* of the consumptive cases which came under his observation. These lesions, are found much more frequently in males than in females.

Affections of the Pleura.—In the article on pleuritis, I have spoken of the connection of tubercles with pleuritic inflammation. That this connection is intimate, morbid anatomy has clearly demonstrated. When these adhesions are extensive, they sometimes present the appearance of a cap, composed of semi-cartilaginous crusts, covering the apices of the lungs, in which tuberculous matter is sometimes deposited.

Diseases of the Abdominal Viscera connected with Phthisis.—During the course of tubercular consumption, the mucous membrane of the alimentary canal, is usually affected. Andral remarks, "that softening of the mucous membrane of the stomach, hyperæmia of the different portions of the intestines, accompanied in many instances by a development of tubercles, are all of such frequent occurrence in phthisis, that they may be fairly considered as constituent parts of the disease.

Morbid condition of the Stomach.—Inflammation of the stomach occurs at a late stage in the disease, and gives rise to anorexia, heat, pain, and tenderness in the epigastrium; and, in some cases, to nausea and vomiting. This condition of the stomach, according to Louis, was an attendant of phthisis in eight cases out of one hundred and twenty-three. When the symptoms arise from gastritis, there are anorexia, pain in the epigastrium, increased by pressure, and other symptoms of gastric derangement; but when from the cough, the appetite is usually good, no epigastric tenderness or pain is present, and the vomiting comes on early in the disease.

Another variety of gastric derangement sometimes exists. It is known by pain and vomiting. But little food can be borne on the stomach; sometimes not more than a spoonful of fluid two or three times a day.

Ulcerations of the Intestines.—The location of the intestinal lesions, is in the ileum, near that part which is adjacent to the

mesentery, and where the glandulæ agminatæ are most numerous. In the colon, the ulcerations are somewhat irregular, often extending to contiguous tissues, and coalescing together. Louis found them extending to the length of nine inches. Cæteris paribus, the more early and extensive these ulcerations of the intestines, the more speedy is the termination of the disease. The cause of this is found in the great emaciation produced by the diarrhœa which is attendant upon these abdominal lesions. The mesenteric glands are very often involved in the constitutional disease. In about half of the cases of the phthisis of children, they are affected; in about one half of the cases in adults.

When ulcerations of the intestines, cause perforation, the result is acute peritonitis, the symptoms of which are often obscure, but rapid. Usually there is a tumid, tympanitic abdomen, with or without pain and tenderness, a sudden prostration, a very rapid pulse, and speedy collapse which soon terminates in death. A chronic form of peritonitis is sometimes the result of tuberculous disease, and a concomitant of phthisis. Its existence may be known by the pain in the abdomen, not very severe, but wandering, moderate in degree, often transient, and followed by tympanitic distension from gas in the intestines.

"After a time the distension diminishes, from an absorption of the liquid effusion, and from a partial removal of the gas, and the abdomen remains enlarged with a dough-like feeling, or with firm ridges, giving the sensation of an unequal firmness on pressure; in addition to these local symptoms, the constitutional symptoms of tuberculous disease are present,—emaciation and loss of strength, hectic, accelerated pulse, and especially, if the rational or physical signs of tuberculous disease of the lungs exist, we need have no hesitation in referring the abdominal symptoms to a tuberculous peritonitis."

"After death we find our diagnosis confirmed by an abundant deposit of tubercles in the peritoneal cavity—false membranes loaded with tubercles and gluing the folds of the intestines together. Sometimes we find tubercles under the peritoneum, and perhaps a considerable effusion of serous, sero-purulent, or even purulent matter in the cavity of the abdomen." [*Swell's Lectures.*]

Disease of the Liver. A remarkable fact in the history of

phthisis is *the fatty degeneration of the Liver.* To phthisical disease it is peculiar. Out of forty-nine cases Louis found forty-seven in which this condition was present. Out of two hundred and thirty that died of other diseases, there were only nine. From these statements of the French Pathologist, it appears that a deposit of fat in the liver is an almost constant attendant upon phthisis. The presence of the fatty matter may be known by cutting the liver and observing the appearance of the scalpel; or by putting a piece of it upon tissue paper, and applying thereto a moderate heat, when the stain of melting fat will appear; or by placing portions of the liver in ether, which, after evaporation, will leave particles of fat. With the microscope we can detect its existence. This condition of the liver is marked by a pale yellowish color, by its enlargement and by its softened texture.

It is most common in females and in drunkards. Why this is so, it is difficult to explain. The functions of the liver are but little impaired, when a large portion of its tissue is converted into fat.

Another condition of the liver, occurring just before the development of tubercles, is *cirrhosis.* This is most frequent when phthisis occurs in countries where intermittents prevail.

Fistula in Ano.—This affection frequently exists in phthisis, and is thought by some authors to be connected with it. Louis, Andral, and Dr. Clark do not find this opinion satisfactorily confirmed. The latter author suggests that its dependence, may be on the venous plethora of the abdomen, which often precedes pulmonary consumption. Dr. Morton, on the contrary, thinks, from facts which have come under his observation, that there may be a connection. Dr. Gerhard also recognizes the existence of such a connection, and says that cases of fistula ought very rarely to be treated by a surgical operation. "I have often," he remarks, "thought that I was rendering an important service to patients by preventing them from allowing industrious surgeons to tamper with cases of the kind mentioned."

Differential Diagnosis.—While treating of the general course of phthisis I described the more important symptoms and their bearing in the formation of a correct diagnosis. Occasionally the varieties and complications of the disease increase the difficulty

of detecting its existence, and, therefore, I deem it best to take a summary view of the more common sources of diagnostic error.

In the first stage the greater amount of accurate discernment is necessary. Before the general symptoms are fully developed,—the physical signs at the same time being scarcely observable,—the diagnosis must be dependent upon the temperament, the constitution and the nature of the predisposing causes, together with the slightest appearances of constitutional debility, hectic fever, cough, and hæmoptysis. Seldom do all of these symptoms occur in conjunction, and hence a diagnostic error often results from the greater dependence upon several variable, uncertain symptoms than upon one or two nearly pathognomonic. The first appearance of hæmoptysis in a scrofulous constitution is a very suspicious symptom, and, if it occurs alone, with no other external phenomena, it should be considered of much more value, than the hectic fever, the excited pulse and dyspnœa. It is very seldom that several symptoms do not exist coetaneously. After one prominent one appears others soon accompany it, and make the diagnosis more and more certain.

Bronchitis sometimes complicates with phthisis, the symptoms of the former sometimes simulating those of the latter. In the former there is more fever, in its first stage more expectoration, but no hæmoptysis. Bronchitis gives rise to the development of the physical signs in the lower parts of the chest, but phthisis in the apices of the lungs. But in some cases miliary tubercles equally disseminated through the lungs give rise to symptoms almost identical with those of bronchitis. Under such circumstances we have in phthisis the continued presence of the mucous or sub-mucous rales, emaciation, night-sweats, unchanged by the treatment which would prove decidedly efficacious in bronchitis.

In the advanced stage of phthisis, the existence of cavities and their attending physical signs, the steady advance of emaciation, the pulmonary hemorrhage, and the non-appearance of these symptoms in bronchitis will afford sufficient evidence to establish a correct diagnosis. Phthisis, too, is most often accompanied with a hopeful state of the mind, but bronchitis with despondency.

Chronic bronchitis may in some instances resemble phthisis. This form of the disease usually occurs in old age—is attended by morning expectoration, the sibilant rale, dyspnœa, and slight fever after exposure to cold. Sometimes emaciation, hectic, and great debility attend it. In such cases, the physical signs indicate the nature of the malady. The sub-clavicular regions, give a good sound on percussion, and to the ear the respiratory murmur. While over the sternal region, and the lower part of the chest, the sibilant or mucous rale will frequently be heard.

There is a complication of this disease, which when it occurs —and its occurrence is very rare,—will puzzle the most experienced physician. The physical signs then become deceptive. It is the complication of chronic bronchitis with dilatation of the bronchi. As before remarked, dilatation of the bronchi may produce a cavity, and that cavity may be partly filled with liquid; and we have the cavernous respiration, and the gurgling rale. In case there is, around this dilated portion of the bronchi, pulmonary congestion, then slight hemorrhage sometimes supervenes, and thus simulates hæmoptysis from tuberculous disease. And again, these dilatations sometimes occur near the apices of the lungs, and thus still more nearly simulate phthisis. When the complication exists it is almost impossible to form a correct diagnosis.

Emphysema sometimes causes difficulty in the formation of a correct diagnosis. If existing at the summit of the lung, it becomes more resonant than normal, and consequently the healthy lung by contrast, seems to be dull on percussion. But this condition of the air-vesicles, gives rise to a feebler respiratory sound, than is heard over the healthy lung; so that the coincidence of great resonance on percussion, with an absence of the respiratory murmur on one side, while on the other the respiratory sound is normal, with apparent dullness,—though not real,—will afford distinguishing characteristics of the nature of the internal lesion.

Pneumonitis, in a *chronic* form, may sometimes simulate phthisis. The distinctive symptoms, are the crepitant rale followed by bronchial respiration, the rusty sputa, the location of the pneumonitis which, very rarely attacks the upper lobes of the lungs; the absence of the hæmoptysis of the expectoration of consump-

tion, of the night-sweats, and of the febrile exacerbations and remissions. But suppose the pneumonitis to attack the upper lobes, as an effect of tubercular deposition. How then can the kind of lesion be determined? With the rusty sputa, is mingled an unusual amount of blood, which arises from slight hæmoptysis. The crepitant rale is present, and after the pneumonitis has subsided, some physical signs remain behind. This latter effect is strongly indicative of tuberculous disease; for pneumonitis leaves no physical signs after it. And so it is with bronchitis. The mucous rale which, when it exists at the base of both lungs, unattended by dullness on percussion, indicates the presence of bronchitis, may be heard only in one lung, and in its apex in case phthisis is present. When this is the case, and especially if the pulmonary disease is chronic, the existence of tubercles is soon evinced. The mucous rale exists at the apices of the lungs, in which case tubercles, of course, are known to be deposited in both. This physical sign marks the period of tuberculous softening. When this process commences, the contiguous bronchi are inflamed, a mucous secretion is its effect, which gives rise to the mucous rale, as the air passes through the tubes partially filled with the secretion. When this sound is heard at the place which tubercles usually occupy, it removes doubt, and establishes a true diagnosis.

But there are on record, cases of pneumonitis of the superior lobes of the lungs, which give rise to a mucous rale that deceives the attending physicians. This result, however, may be obviated by attending to the history of the disease; pneumonitis passing rapidly through its different stages; phthisis progressing slowly, and surely to a fatal termination.

Section V.

CAUSES OF PHTHISIS.

Inquiries into the causes of phthisis have been very extensive, and have brought to light much useful knowledge respecting its prevention. But certainty is not as yet attained, and many influences which have been supposed to give rise to phthisis, are not after all proved to be the real causes of its production. In draw-

ing conclusions in medicine, many mistakes are made. From too limited observation of a few phenomena, varied by modifying circumstances, deductions are often drawn, in which there is neither truth nor reason. One very prominent cause why so much diversity of opinion prevails in relation to the nature and treatment of phthisis, is the different manner, and the degrees of caution, used by physicians in making their investigations. In determining the causes of phthisis, the same difficulties that meet the philosopher in arriving at any definite conclusions,—conclusions the truth of which can be demonstrated,—meet also the physician. We should then, when examining statistics in relation to the causes of disease, before drawing conclusions, inquire into the character of the circumstances, under which the statistics were made.

Among the causes of phthisis, hereditary predisposition occupies the most important place. And yet this hereditary tendency explains nothing in relation to the real cause of the disease. It is the name of a fact not a cause, which is sure to produce specific results. We must, therefore, in order to arrive at anything definite or practical, seek to find that in which the fact has its origin —whether it be a peculiar state of the blood, a want of functional power,—in the digestive organs, or in the respiratory apparatus. Vitality is the effect of so many conditional causes, each liable to vary in intensity and thus by that variation, to influence the result,—the degree of vitality,—that it is difficult to tell in what ultimate change phthisis has its origin. But the nearer we can ascend to the sources of knowledge, the more general and conditional that obtained knowledge becomes, for all other knowledge, related to it, as species to genera. Accordingly it is evident, that, if chemistry or optics could detect that condition of the blood,—whatever it is—which is most prevalent in the progeny of tuberculous parents, before deposition of tuberculous matter takes place, a general fact would be obtained of more value than many particulars often spoken of by medical writers. From pathology or from chemistry, we gain no evidence, that those who are predisposed to phthisis, have blood differing essentially from that of others. And the existence of the hereditary tendency has been questioned by some recent observers. But because of the non-appearance of an abnormal change in the con-

stituents of the blood, except in rare cases, or because the existence of that tendency is denied, we should not, therefore, conclude that hereditary influence does not exist. It may exist, but not as an ultimate cause, ever producing a certain result.

In all the blood probably contains the elements of tubercle. Why then do those elements leave the mass of the blood, and locate, as foreign or heterogenous matter, upon the surfaces of membranes or in the texture of organs? And why does this effect take place more frequently in the children of phthisical parents? To answer these questions according to science will require a more philosophic spirit than mine. And yet, to me it seems rational to suppose that the constituents of the blood are held together, by an affinity—be it chemical, or vital,—the strength of which is modified in degree by any cause which can debilitate the system,—which can lessen the nutritive properties of the blood. Certain constituents of the blood, by that affinity, are held together by a stronger force than others, or, certain of them, have a stronger affinity for surrounding elements than others. And whenever from any cause, from deficient nutrition, or from impure air, this affinity is lessened, then upon the surfaces of those membranes, in which exosmose is easily effected, certain elements of the blood,—those having a strong affinity for other textures, not being at all within the control of vital affinity,—are exuded. The second question it seems to me, involves nothing more than this general principle in all animal life;—the tendency to impart to the progeny the attributes of the parent. As is the character of the germ, so is that of its natural completed product. Hereditary predisposition seems on analysis, to resolve itself into this origin. A certain train of causes, acting for a long time and in one direction, will give rise in those not predisposed to phthisis, to tuberculous disease, or at least will cause a condition of things, approaching to that which will give rise to tubercles. A parent has been under certain influences, but they may not have produced in his system, tuberculous disease in its developed form. This same condition is handed down to the progeny, and then the same causes act upon the latter which did upon the former. But in the latter, at the beginning of life, the condition of the system is already less adverse to the development

of phthisis than was that of the parent at the beginning of his existence. And hence the acting of that train of causes upon the child, which, in the parent did not produce phthisis, but which had he lived long enough, would have done so, develops phthisis in the child. I ask, then, if we seek for an ultimate cause, to what shall we attribute the beginning of the predisposition? Does it not spring from the other causes of phthisis? and is it anything more than a continuation of the effects of exciting causes? If not, our prophylactic treatment, in order to strike at the root of the tree, should be directed to the removal of those causes which, when long continued, give rise to any disease whose tendency is to produce, in the parent, depression of the vital forces, and thus secondarily to beget in the child that predisposition of which authors speak. There is some variation in the statistics of different authors, concerning the number of phthisical patients in a given number, who have been born of consumptive parents. Dr. Swett, deducing his conclusion from private practice, thinks that seventy-five in a hundred of phthisical patients, belong to consumptive families.

"The influence of *age* in the production of phthisis is very remarkable. A large proportion of those affected, die between the ages of twenty and thirty years. Dr. Walshe includes forty-one per cent, of the whole number between these periods. Briquet states that three-fifths of those who suffer from the disease are attacked between the ages of twenty and thirty-five years. Children are by no means exempt from its ravages. While all admit the rarity of tuberculous deposits in the lungs of the fœtus, still they are sometimes noticed. The lungs of a new-born infant may be completely studded with tubercles. Although the tendency to the disease rapidly diminishes after the age of thirty or thirty-five years, yet it is sometimes met with even in advanced life.

"Sir James Clark places the mortality, between the ages of fifty and sixty years, at 108, as compared with 285, representing the mortality between the ages of twenty and thirty years. My own impression is, that when individuals who have passed the middle period of life are attacked with phthisis, the disease progresses less rapidly than at any earlier period of life, and that many thus

die, after having suffered from the disease for a considerable portion of their lives."—[*Swett's Lectures.*]

Occupations of Life.—Concerning the causes of phthisis, Lombard, of Geneva, has given us some valuable statistical information. The result of his researches is thus stated:—"The circumstances which increase the tendency to phthisis are poverty, sedentary habits, violent exercise of the chest, an habitually bent position of the body, impure air in workshops, the inhalation of certain mineral and vegetable vapors, or air loaded with a coarse or impalpable dust, or with light, thready, elastic substances."

"The circumstances which seem to exert a favorable, preservative influence, are easy circumstances, an active life in the open air, regular general exercise, the inhalation of watery vapor, and finally, animal and vegetable emanations."

This general summary of the results of extended observation is worthy of consideration. The influence of poverty in the production of phthisis is considerable. But the attending circumstances, anxiety of mind, exposure, poor food and deficient clothing, have without doubt much to do in producing the result.

The proportion of deaths from phthisis in those professions practiced by the higher classes of society is, according to Lombard, only one-half as great as among the poorer classes. In Geneva only fifty in one thousand deaths occur from phthisis among those living on their incomes, while the average number of deaths among all classes is one hundred and fourteen in one thousand.

Sedentary habits are prone to produce phthisis. The practice of sitting with the body inclined forward, thus preventing the free expansion of the lungs, and the action of the stomach, and other abdominal vircera, is one cause of the injurious tendency of a studious life. Among shoemakers, and tailors the proportion of phthisical patients is very large.

The influence of the inhalation of various substances is a subject of interest. The inhaled substances operate in two ways: by absorption, and by the mechanical irritation which they produce. Of the former class are gasses and vapors. Of the latter, minute particles of dust. The inhalation of the mercurial vapor tends most of all to the production of phthisis. It is the general opinion of physicians that mercurials are injurious to phthisical

patients, and that its use tends to produce that state of the system favorable to the development of phthisis. Sir James Clark says "that long courses of mercury on the constitution, may give rise to the scrofulous constitution."

Those exposed to the vapor of lead, and other mineral agents are not particularly liable to phthisis. Among those who inhale the vapor of lead the number of deaths from phthisis, in one thousand is only twenty-one, while among those who inhale that of mercury there are fifty-three in a thousand.

The inhalation of dust whether animal, vegetable or mineral, oftener produces a fatal form of chronic bronchitis, than a deposition of tubercles. M. Lombard thinks, that mineral dust is the most injurious of all. Those agents which exert the most injurious influence are the dust arising from flints, sandstone, and from steel; and hence stone-masons, miners, coal-heavers, brass polishers and metal grinders are more liable cæteris paribus than others to phthisis. Among animal agents, the dust arising from flax-dressing, or from feathers and hair is most injurious; among vegetable agents the dust arising from the dressing of cotton.

Lombard's opinion, that the inhalation of watery vapor is a preventive of phthisis, should be somewhat modified. An atmosphere, warm and damp, may perhaps have a beneficial influence in phthisis. But in our country in which moisture and cold are often combined, such a result is seldom found to be true, but, on the contrary, the moisture and cold tend to produce phthisis. All along the Atlantic coast, those cold chilly winds, accompanied with dampness, are among the most powerful causes of consumption incident to this climate. From phthisis M. Lombard thinks that butchers, tanners, and leather dressers are remarkably exempt. Of late it has been asserted that those whose occupation tends to keep the surface of the body covered with oily matter, are not so liable as others to phthisis.

According to the observations of M. Lombard vegetable emanations are useful to prevent tubercular disease. "But," observes Dr. Swett "the truth of his statement may well be doubted. In certain regions, the healthful influence of vegetable emanations may be true enough. But if the various forms of malarious disease, are dependent upon this cause, then we must class these

emanations among the most unfavorable influences in the production of phthisis. There is, indeed, a popular opinion in this country, that a residence in a malarious region is favorable to phthisical patients. But this opinion is the very reverse of the truth. Malarious diseases by impairing the general health, favor the development of phthisis, and much increase its mortality."

M. Lombard, from his investigations, drew the conclusion, that exercise of the voice, exerts a favorable influence.

Phthisis is usually less rapid in its progress in feeble constitutions than in those more vigorous. Louis is of the opinion that the lymphatic temperament predisposes to phthisis. But it is evident that an attempt to distinguish the different temperaments could not lead to definite conclusions.

In estimating the amount of influence which climate exerts in the development of phthisis, we are chiefly dependent upon statistics. Of late some light has been thrown upon this subject by the valuable reports of the surgeons of the British army, and those of the late Dr. Torrey of the United States army. By them many erroneous ideas have been corrected. Formerly it was supposed that phthisis prevailed almost exclusively in temperate latitudes, in central Europe, in the northern and middle parts of the United States. Accordingly phthisical patients have been advised to remove to tropical countries, in order to receive protection.

But these reports prove that a permanent residence in tropical climates, instead of preventing the development of phthisis, tends rather to an opposite result. There is a difference, however, in the unfavorable tendency of tropical regions, on the same parallels of latitude. The West Indies are more favorable to the production of phthisis than the East. In the army in Great Britain the number of phthisical patients was six and one half in every one thousand men. In the West Indies, in Leeward and Windward Islands, the number was twelve in one thousand; in Jamaica, thirteen; in the Bermudas, nine. In the Mediterranean the average number of phthisical patients is six in one thousand.

The climate of the East Indies is more favorable to the prevention of phthisis than that of the West. In Ceylon and along the Bay of Bengal it is seldom known. The climate of Sweden although cold, is more favorable to the prevention of phthisis than

that of England. In Canada, too, there are less deaths from this disease than in many parts of the United States and England.

"Contrary to general belief," says Dr. Swett, "consumption is more common along the Atlantic coast, from Delaware Bay to Savannah, and at the southwestern ports, than at the northern Atlantic ports, and at those situated on the great lakes. While the least ratio is found at those parts in the northern division of the United States, remote from the ocean and the lakes. Thus, so far as our own country is concerned, the regions least predisposing to phthisis, are the inland states in the northern division, removed equally from the influence of the ocean and of the great lakes."

To those localities, then, we should send consumptive patients, rather than to those which they have formerly visited for the improvement of their health. But it is not under all circumstances best to advise a removal from home, in order to obtain the benefit of a new residence. The stage of the disease, during which such a removal will prove most beneficial, is its formative one,—that stage in which other remedies have the most beneficial effect.

Malaria is a poison which tends to undermine the constitution, and to lay the foundation of phthisis. Phthisis is more frequent in malarious regions. To this, however, there are exceptions. In New England *malaria* exerts little or no influence, while consumption is very prevalent.

The favorable effect of a sea-faring life is generally admitted, and is confirmed by good evidence.

Acute Inflammations of the Chest.—Inflammations of the chest, such as bronchitis, pneumonitis, and pleuritis, have been supposed to exert an unfavorable influence. The two former diseases I shall in the first place consider. Patients often trace their phthisical difficulties, back to a neglected cold, or a slight attack of bronchitis or pneumonitis, and, to that source attribute the first cause of the disease. For this opinion pathology has shown that there is but little foundation. Bronchitis and pneumonitis attack the lower lobes of the lungs, or the larger bronchial tubes which are not the ordinary seat of tuberculous deposit. Inflammation is by no means a constant attendant upon the development of tubercles.

Pleuritis is sometimes secondary to the development of phthisis, and sometimes is its antecedent and exciting cause. It is much more liable to be so than either bronchitis or pneumonitis. Very often we meet with cases in which the phthisical affection seems to immediately follow the pleuritis. We may safely conclude, that pleuritis is either a cause of the development of phthisis in those who would not have had the disease, were it not for the pleuritic inflammation, or that it has the power to arouse into activity the latent form of consumption. It is considered much more favorable to the development of tubercles, than the inflammatory diseases of the air-passages, and parenchyma of the lungs.

Cæteris paribus, we should conclude, that if inflammatory affections of the thorax were causes of phthisis, the latter disease would be most frequent, where the former prevail to the greatest extent. There should be on this supposition, a certain ratio existing between the prevalence of pneumonitis and bronchitis, and that of phthisis. But it is not so. In their ratio to phthisis, they differ from the malarious diseases. According to Dr. Forry's Reports, where phthisis is least common, there bronchitis is most prevalent. Nor is there any definite relation existing between the prevalence of pneumonitis and pleuritis, and that of phthisis.

Is phthisis contagious? Dr. Watson replies:—"No: I verily believe it is not. A diathesis is not communicable from person to person. Neither can the disease be easily generated in a sound constitution. Nor is it ever imparted in my opinion, even by one scrofulous individual to another. Yet in Italy a consumptive patient could not be more dreaded and shunned if he had the plague. A girl dying of phthisis, is nursed by her sister, who afterwards droops and dies of the same complaint. Here the presence of the peculiar diathesis is strongly presumable. But the parents may be different in blood. A wife watches the death-bed of her consumptive husband, and presently sinks herself under consumption; and there may be no traceable, or acknowledged example of scrofula in her pedigree. Yet even here the latent diathesis may be presumed to exist." Other influences aside from any contagious influence hasten on the development of the disease. These are watching, anxiety, and confinement in the ill-ventilated apartment of the sick-room. The effluvia, arising from a patient in consump-

tion, and the attendant circumstances should be considered as exciting causes, the influence of which can hasten the progress of tuberculous disease in others. And hence sleeping with a person laboring under phthisis, especially in its last stage, should be avoided as any other exciting cause of consumption.

Intemperance.—This has been considered a cause of phthisis. Sir James Clark remarks:—"we believe that the abuse of spirituous liquors among the lower classes in this country is productive of tuberculous disease to an extent far beyond what is usually imagined. Indeed, it is only necessary to observe the blanched cadaverous aspect of the spirit-drinker to be assured of the condition of his internal organs."

This tendency of intemperance is, however, doubted by others in the profession, whose observations are extensive. Of 35 persons dying of various diseases, all of whom were decidedly intemperate, and most of them grossly so, in 26, according to Dr. J. B. S. Jackson, of Boston, [New England Quarterly Journal of Medicine and Surgery, July, 1842, p. 30,] no tubercles were found; in 5, there were tubercles in the lungs; in 1, in the bronchial glands; and only 2 died of phthisis. In several of the most striking, the organs were as free from tuberculous disease, as those of a new-born infant. These results led Dr. Jackson to suggest, whether intemperance may not have some effect as a prophylactic? [Cyclopedia Pract. Med. Art. Phthisis.]

Dr. Swett observes—"Two medical gentlemen attached to the public dead-house in this city,—New York,—in which bodies are deposited, that are found in the streets, or without friends,—discovered in about seventy post-mortem examinations of those who died of the most confirmed and aggravated intemperance, not a single case of tuberculous lungs. A most surprising result, when we remember that this unfortunate class have probably long suffered from poverty, bad nourishment, and exposure to the weather; influences which are regarded as predisposing to tuberculous deposit. A large proportion of confirmed drunkards suffer from hepatic disease. Is a tendency to hepatic disease antagonistic to the development of tubercles?" Some authors think so. And yet more extended observation is necessary in order to fully substantiate the truth of such a conclusion. The *modus operandi* of

alcohol in acting as a preventive, is not as yet so fully understood as could be desired. And, the opinion, that it really is beneficial in the prevention and cure of phthisis, is as yet deficient in demonstrable evidence. And yet, on analysis, we may find some ground on which such an opinion may reasonably be founded. Those means which act as revulsive agents, generally arrest the progress of those diseases to which they are opposed in their effects. Many hygienic means operate in a similar way. It is generally admitted that certain conditions of the system tend to arrest the development of tubercles. Among these are pregnancy, certain chronic bronchial affections, and some diseases of the heart. Now according to Rokitanshy, all these conditions tend to produce venosity of the blood—an effect similar to that produced by hepatic derangements.

It is also the conclusion of Broide, and others, that alcoholic drinks taken into the stomach, pass by absorption, or endosmose into the blood-vessels and with the blood circulate in a free state. Liebig asserts that alcohol, when circulating with the blood, unites with its oxygen, and forms carbonic acid gas—thus tending to produce a venous state of the vital fluid. Bennet's testimony is in accordance with that of Dr. Jackson. Dr. Swett remarks, "that tuberculous cavities are more frequently found healed, in the lungs of spirit drinkers, than in those of any other class." This fact, however, is far from being absolute proof that the alcoholic stimulus, is alone its cause. Some other stimulant in an anæmic or scrofulous state of the system might be equally as efficacious. If so, we should by all means use the substitute, and not entail upon the patient a pernicious habit by our advice. Under some circumstances,—perhaps in asthenic cases of phthisis —some mild alcoholic beverage combined with nourishing food, is very useful. By its use in this manner the animal temperature is elevated, and the nutritive functions stimulated to increased activity. Concerning its utility, the discriminating practitioner can learn more by experimental knowledge than by theoretical.

Dyspepsia.—In dyspeptic diseases, many authors have placed one prominent cause of phthisis. And well it is that they have done so. For since tubercles depend for their development upon a want of nutrition in the blood, and since dyspeptic diseases de-

prive the blood of its nutritive properties, there is reason to believe, that in this source, tubercles may have their origin.

There are other causes of phthisis which are seldom described in medical works. Of these, one is masturbation which, by its debilitating effect upon the general constitution, tends, in an eminent degree, to favor the development of tubercles. Another cause is the use of such remedial agents in the cure of disease, as leave after their primary effects have subsided, secondary ones, which, in the end prove worse than the original disease. One week's sickness treated heroically, often lays in the system the foundation of chronic complaints, which in their results terminate only with the end of life. It is generally admitted that mercury is injurious in scrofulous affections, and that its action rather than otherwise, tends to develop that disease. If this be so,—and the history of thousands of invalids corroborates its truth,—then why may not its action upon the system directly induce tubercnlous disease? Indirectly, if not directly, by debilitating the system, by destroying the red blood, by inducing emaciation, it so influences the mass of the fluids, as to leave the system liable to the ingress of phthisis,—it leaves the territory unguarded by any vital force—even by that mysterious one, "*the vis medicatrix naturæ.*"

A patient somewhat predisposed to phthisis, takes a severe cold in the autumn. Febrile symptoms supervene. There is according to the opinion of some, an exalted condition of vital action; and consequently all the instruments of the anti-phlogistic regimen and treatment are immediately used to subdue the inflammation. After a number of weeks the patient may slowly recover. But his digestive organs do not seem to be healthy. Strength does not return; a slight cough begins, and in from six months to a year, phthisical symptoms are fully developed. Such cases often occur, and so often, that the more judicious physicians of all creeds, even those standing on the conservative platform, now begin to abandon the use of dangerous remedies, not because—as some often pretend—diseases are now so different in their nature as not to require the same treatment, but because the application of science to the study of medicine has exploded the idea, that it is necessary to hazard life, by the use of deleterious agents in order to produce a speedy and complete cure.

Prognosis.—In those cases in which the disease is far advanced, the prognosis is always very unfavorable. So small is the chance of recovery, that the physician has no good reason to encourage the patient or the friends. But morbid anatomy has demonstrated that even in the last stages recoveries do take place; the cavities are filled with the chalky concretions, their parietes contract and cicatrices are produced. What else, than the curability of phthisis do such facts teach? On this subject Dr. Swett remarks, "I never shall entirely despair of the life of a patient with phthisis, when I recollect what I once witnessed in this Hospital. A patient was admitted with phthisis. The disease was perfectly well characterized, and in its most advanced stage; a large and well marked abscess existed under the right clavicle. Indeed, the signs of this lesion were so distinct, that I was in the habit of calling the attention of students in attendance to them as perfect in their characters. On one occasion as I approached the bed for this purpose, I found the patient who had been gradually sinking, in such a state, that it seemed to me improper to disturb him. He was bolstered up in bed, with his head falling upon his shoulder, breathing with great difficulty, bathed in perspiration, and with a rapid and feeble pulse. The next day my attendance ceased, and after two months, was again commenced. On entering the ward, the house physician called my attention to a man, dressed, walking about the ward apparently stout and well, although somewhat pale. To my great astonishment I found that it was the very case of phthisis I had left two months before apparently dying." The same author testifies that he has known a number of patients who have had all the evidences of phthisis, and yet have recovered.

In such cases, however, the subsequent health is not so good as it would have been had they not been injured by the phthisical lesions. At times, a little cough and dyspnœa continue, but the patient is able to attend to ordinary business. The number of those whose lungs evince, after death, indications of the effect of the curative process, is much greater than has been supposed. Indeed, it is not uncommon to find in the lungs of those who die of almost every form of chronic disease, chalky concretions, ancient traces of tuberculous disease. A French physician found

in one hundred women, all above sixty years of age, and dying of various diseases, fifty-one who presented the curative indications of tuberculous disease, and chiefly by the formation of chalky concretions. To such testimony, the common reply is, that they were not after all, cases of phthisis. If so, and if no case ever did recover after cavities were fully formed, how I ask does it happen that the lungs in so many cases show the indications of cured phthisis? No one who has any knowledge of tubercular consumption will affirm, that it is not always a formidable disease, that its prognosis is not always unfavorable. But it is not, therefore, the part of reason, to deny facts, plainly testifying that the disease, under favorable circumstances, and especially when early treated by the most appropriate human means, does occasionally terminate favorably. Dr. Wood of Philadelphia, mentions two instances of this kind in medical men of that city. One of the patients was affected, when a young man, with all the symptoms of phthisis, including frequent attacks of hæmoptysis, severe cough, hectic fever, &c., from which he completely recovered, and continued exempt up to the time of his death, which occurred many years afterward of typhoid fever. [See N. Am. Med. and Surg. Journal, viii. 277.] The second case was the late Dr. Joseph Parrish, who in early life had phthisis, and recovered. At an advanced age he died, and cicatrices were found in the upper part of one lung.

Section VI.

TREATMENT.

The indications in the treatment of phthisis are first, to prevent the further deposition and development of tubercles, and, secondly, to protect, as far as possible, the lungs and other organs from their injurious results.

1. *To prevent the development and deposition of tubercles.*—The means both prophylactic and remedial, which can be of any utility for this purpose, must be directed to the attainment of *this result*;—the production of that state of the solids and fluids which is most adverse to the development of tubercles. The primary

pathological changes in phthisis, are few and simple. And so they remain until the sequences of the repulsive powers of the system, produce lesions of textures, more difficult to be removed, than even the primary changes. The remedies which alter the primary state of the tissues, are also of a simple character, and only a few are required, when seasonably and properly applied. These agencies must excite absorption and secretion.

A diminution of the nutritive properties of the blood in phthisis, is now a well established fact. In order to remove this condition, we must therefore direct our remedial and hygienic means to those sources, whose condition determines the character of the blood.

The air is one source—the chyle the other. Whatever tends to keep these sources of life pure, must tend to keep pure their product, the blood. Pure air then is indispensible to the prevention and cure of phthisis. And since exercise in the open air, increases respiration, thereby tending to expose the blood to the action of atmospheric elements, it becomes a potent means of preventing the progress of tubercles.

To be effective, this must be long continued. A short walk now and then is not sufficient. It must be persevered in, in order to have any permanent effect. At first it should be gentle, and not continued until exhaustion is produced. Its increase should be in proportion to the increase of strength. The state of the weather, should not often be considered an insurmountable obstacle. Let the clothing be adapted to the circumstances, and proper care be taken after exercise, not to take cold by exposure to currents of cold air, or by too quickly taking off the clothing, and there need be no fear as to the result. There is prevalent in the community a great error, in regard to the prevention of catarrh by close confinement. Close confinement, instead of being a preventive, is an actual cause of catarrh, and many other pulmonary difficulties. Experience fully confirms this opinion. Those who are most sedentary in their habits, the least exposed to the vicissitudes of the weather, are cæteris paribus, most liable to pulmonary consumption. These remarks as to exercise, of course, apply to the early stage of phthisis, when there is no great debility.

The character and degree of exercise must depend upon circumstances. Severe exercise has in some cases proved beneficial, by arousing to activity the vessels of the minutest tissues. By this, sudden changes in the secreting and excreting vessels have been effected. Dr. Salvadori directed his patients in the morning to climb, as quickly as they could, some eminence, till they were out of breath, and bathed in sweat; and then to place themselves near a large fire to increase the perspiration. Afterwards they were directed to change their linen, and gradually withdrawing from the fire, to partake freely of salted meat and wine.

Dr. Parrish, who, having no faith in the treatment of the profession in this disease, threw all their remedies aside, and followed the advice of Sydenham,—makes the following remarks:—"Vigorous exercise and free exposure to the air, are by far the most efficient remedies in pulmonary consumption. It is not, however, that kind of exercise usually prescribed for invalids—an occasional walk or ride in pleasant weather, and strict confinement in the intervals—from which much good is to be expected. Daily and long-continued riding on horse-back, or in carriages over rough roads, is, perhaps, the best mode of exercise; but, where this cannot be commanded, unremitting exertion of almost any kind in the open air, amounting even to labor, will be found beneficial. Nor should the weather be scrupulously studied. Though I would not advise a consumptive patient to expose himself recklessly to the severest inclemencies of the weather, I would, nevertheless, warn him against allowing the dread of taking cold to confine him, on every occasion, when the temperature may be low or the skies overcast. I may be told, that the patient is often too feeble to bear the exertion; but, except in the last stage, when every remedy must prove unavailing, I believe there are few who cannot use exercise out of doors; and it sometimes happens that they who are exceedingly debilitated, find upon making the trial, that their strength is increased by the effort, and that the more they exert themselves, the better able they are to support the exertion."

The temperature of the body should be equal, not exposed by a want of clothing, or sudden changes of heat and cold. The clothing, therefore, should be such as not to permit the body to be

suddenly chilled. Flannels, and woolen clothes generally are best adapted to sustain an equilibrium in the heat of the system, and thus to keep up an equal circulation of the blood. The influence of climate, in accomplishing this indication, is often considerable. The mild winters of some tropical regions, in two respects, are beneficial to a phthisical patient. First, they tend to promote, more than a cold, changeable climate, the cutaneous capillary circulation, and secretion, and also, in the second place, afford to the patient better facilities for exercise in the open air. "In choosing a place of residence," says Dr. Wood, "preference should be given to those situations which are at the same time dry and of a uniform temperature."

In Madeira, the climate is very favorable to the cure of phthisis. It is perhaps least prevalent in Ceylon and along the shores of the Bay of Bengal. But the increased liability existing in those localities to hepatic and abdominal diseases, makes a residence there, dangerous.

In the West Indies, Santa Cruz is perhaps the best place; and the accommodations there derivable are good. In our country the interior of Florida, is thought by Dr. Swett, to be the best place for a consumptive patient. He recommends, the patient at the approach of Spring, or as soon as the heat becomes a little oppressive, to move a little northward, keeping back from the sea coast. To spend a month or two at Aiken, in South Carolina, to reach Richmond, Virginia, about the beginning of May, and to return to the Northern States about the tenth of June. He, also, recommends patients to go South sometime in October or early in November. In some cases,—in those who bear well the cold of autumn,—he thinks that they may stay North until December or even January.

What kind of patients most frequently receive benefit from a change of climate? They are, in general, those in whom the disease has not far advanced, in whom there is no hereditary predisposition, but, on the contrary a strong tendency to health, a strong constitution. Those in whom the phthisical affection is not complicated with any other disease, in whom its progress is slow, located on one lung only, and confined to a small portion, showing a strong tendency to pause in its development.

The *regulation* of *diet* is also an important part in the treatment of phthisis. This should consist of those articles which, while they are easily digested, afford a rich supply of nutriment to the blood,—enough to combine with the oxygen of the air and produce that condition of the circulating fluid most adverse to the development of tubercles. Among the more nutritious articles allowable in the first stage, are beef, eggs, oysters, mutton; among those less nutritious, are milk, fish, farinaceous articles and digestible fruits.

The greater the amount of exercise, the more nutritious should be the diet. Moderately stimulating drinks, such as porter, ale, and pure wine, are often very useful. To the use of any alcoholic beverage in this stage, some object; saying that it tends to produce inflammatory action. This may be so to some extent. But it should be recollected, that phthisis is in an eminent degree a disease of debility, and its attendant, fever,—especially in the first stage, is of an irritative character, arising, not from phlogosis, but from anæmia, or from defective nutrition. It is the opinion of Prof. William Tully, that pure natural wine,—the venous principle independent of the water and other substances with which it is mixed,—is digestible to a limited extent, and affords to the system a small amount of nutriment. (Tully's Materia Medica, Vol. 1, No. 1, p. 4.)

Mental influences are frequently important therapeutical agents in this disease. Disappointment, anxiety, and grief produce a depressing influence, directly tending to arrest digestion, and thus deprive the blood of its normal amount of chyle. Intense study, or any sedentary business which occupies the attention too constantly, should be avoided. Hope should be encouraged. The patient should not be told by every friend whom he may chance to meet, that his case is consumptive. Let his mind be diverted, by amusing incidents, and by a variety of pleasing and interesting novelties. To this diversion of the mind, traveling owes much of its utility as a remedial agent. Short sea voyages may be useful for this purpose.

Medicines in this disease are extremely limited in their influence. Sometimes, when judiciously prescribed, and when the best possible selection is made, they arrest the progress of the

disease, or at least, when combined with proper hygienic means, they render a cure more probable than it otherwise would be. But every agent which tends, either primarily or secondarily to produce debility,—such as those comprised in the antiphlogistic regimen,—powerful cathartics, diaphoretics, in short all general evacuents, are in my opinion contra-indicated, and, therefore, their use should be entirely abandoned except in cases complicated with other diseases.

Among many practitioners of experience, the practice of administering frequent emetics, has been prevalent. There is unquestionably a period in which these, when properly given, have a beneficial effect. That period is in the incipient stage, when tuberculous matter is not softening, and when the capillary circulation, and the digestive functions are first deranged. My opinion is, that, in incipient phthisis emetics are serviceable, chiefly through their power of exciting capillary action, and of diverting from the pulmonary tissues, all morbid matter. With them it is necessary to use the hot air or vapor bath, followed by long continued frictions, and by strong tonics, and nourishing food. One prominent cause of failure, in this as in other courses of treatment, is this:—the patient is prone to think, that the medicine will do the cure without exercise, and the adoption of other hygienic means. It would be well for the consumptive, if physicians, while regulating the kind and administration of medicine, would pursue a course with the patient, similar to that adopted in hydropathic establishments,—a course of exercise, and rigid physical discipline.

When such complications exist as to make emetics, cathartics, or other evacuant remedies necessary, they may be given. In febrile phthisis, diaphoresis should be promoted, and the stomach, if in a morbid state, cleansed by an emetic. Other organs should receive such attention as their pathological condition may seem to indicate. The efficacy of repeated emetics in all cases, or even in a majority of cases of phthisis, I very much doubt. When the stomach is not particularly dyspeptic, they, after softening has commenced, seem to me decidedly injurious; in the first place, they tend to increase the bronchial secretion which, diluting the tubercular masses in the minute ramifications of the bronchi,

produces a tendency to the softening of tubercles. And secondly, they debilitate the system, by the relaxation which they occasion, and by the prolonged diaphoresis which they induce. I very well know that they often relieve the dyspnœa, and many times other rational symptoms. But this is merely the primary or palliative effect; the secondary, is the production of debility. Phthisis demands the use of revulsive means,—means which determine away from the lungs, all matter that may seek an exit from the system through the bronchial membrane, but those means should not tend to produce debility,—the bad effect of emetics. Consumption, consequent upon the recession of some exanthematous eruption, demands, in a special manner, the use of such agents as tend to throw upon the surface morbid matter. But this revulsive effect must be produced, if produced at all, not by such cutaneous evacuants as act at the expense of the strength of the patient, but by those which call to the surface the full and normal quantity of blood, and do this too, without producing debility. How can this be done? My method is to place the patient over the vapor of water and alcohol, until the superficial veins are full, and a warm glow is felt over the entire body. I then apply with a sponge, either tepid or cold water, according to the reacting power in the system, and follow by continued and brisk friction.

There is no need—and indeed it is decidedly injurious, to continue the bath until relaxation follows. The tonic, stimulating and cleansing effect is all we want. This, in the early stage, should be frequently repeated, especially, if the circulation is feeble, in the extremities. In most cases this remedial agent causes the pulse to diminish in frequency, but to increase in volume, in short, it changes for awhile the small jerking pulse of irritative fever, to the more full, slower pulse of health. For stimulating the surface, after the bath, mustard water is often highly serviceable in cases of debility.

Dr. Gallup, speaking of the efficacy of the universal warm bath in phthisis fully corroborates the utility of this mode of applying caloric to the system. "In nine cases out of ten," he observes, "the disease is excited by cold, and the first treatment requires the application of caloric in some form to the surface. Capillary action should be excited on the surface by caloric, by

frictions and by such exercise as the patient can bear. Of the utility in phthisis of the warm bath I am fully convinced. I think it indispensible in recent cases, and enjoin it every, or every other evening, before retiring to bed. It may be continued a month or two, and occasionally for a much longer time, if there should be chilliness, or dryness of the skin. It even moderates the hectic paroxysms, and converts the colliquitive sweats into a warm perspiration. A temperature of about 100° Fahrenheit may be employed, but always such as to be agreeable, and easily borne by the patient. Sometimes the bath may be impregnated with chloride of sodium. The warmth on the surface should be sustained by occasional rubbings with warm flannel, by a sufficiency of clothing, with flannel next the skin and some agreeable nutriment mostly in a fluid form."

For internal remedies at this stage I use preparations of iron, the carbonate, prussiate, or iodide, according to the indications. The sirup of the iodide of iron mixed in an alterative sirup, containing a considerable quantity of sugar, is a very excellent compound. It may be prepared and administered as directed in the article on pleuritis.

The wild-cherry bark, the prunus virginiana, is highly recommended as a tonic to the digestive and nutritive functions, and as a sedative to the nervous system. A very convenient form of administering this remedy is in the form of the officinal infusion, which may be given in the dose of a large wine-glassful, two, three, or four times a day, and continued for a long time in case the remedy seems to be adapted to the exigencies of the case. Should this become offensive pipsissewa, or simple bitter tonics may be used with benefit. Among these are salicin, hydrastin, quinine, columbo, quassia and gentian and ginseng. When the pulse is very frequent, to either or all of these tonics a suitable quantity of hydrocyanic acid may be added in order to lessen the rapidity of the pulse, and allay the irritability of the system. Tonic and alterative compounds should be composed of those articles which seem best adapted to the removal of the symptoms. The following is very useful :—

℞	Rumicis		
	Stillingiæ		
	Inulæ helenii		
	Xanthoxyli		
	Pruni virginianæ		
	Solani dulcamaræ	a a	ʒ j.,
	Aquæ pluvialis		Oij.,
	Bulliant. Decanta.		
	Adde		
	Sacch. alb		ʒ iv.,
	Potassæ hydriodatis		ʒ ss.,
	Spiriti vini		q. s.

Dose—one table-spoonful three times per day.

"The remedy which has of late had the greatest reputation as a curative agent in this disease, is the cod-liver oil,—oleum jecoris aselli. This oil is brought to market in three principal varieties; the best and most tasteless is nearly or perfectly transparent, with but a slight odor or taste, and is almost always taken by patients without much difficulty."

"The dose of the cod-liver oil, is a table-spoonful three times a day, taken in a little of the froth of beer or porter; any other liquid not possessing any positively medicinal properties may, however, be used in place of the froth of malt liquors. A very good, and perhaps a better mode of taking the oil, is to chew a small piece of orange peel, then to swallow the oil, either pure or floating in some aromatic infusion, or a little rose or orange-flower water, and afterwards again to chew a fragment of the orange peel.

"Many persons are not able to take the oil three times a day without repugnance; it may, however, often be given to them twice a day without difficulty. In these cases it should be given about eleven or twelve o'clock in the morning and again in the evening. It is in general best to begin with a less dose than a table-spoonful, and as soon as the patient becomes a little accustomed to the remedy, it should be increased to the usual dose. The doses should not be so large as to excite purging. Some consumptive patients are not able to take the cod-liver oil; in

some it produces much nausea and an insufferable disgust. This, however, sometimes subsides, and the patient acquires, by changing the manner or vehicle of administration, the power of retaining the medicine on the stomach. Diarrhœa contra-indicates the use of the oil, especially when it cannot be arrested by a few drops of laudanum."

"When the cod-liver oil does good the patient increases in flesh, and loses, to a certain extent, the characteristic physiognomy of phthisis. The pain and cough also, diminish—sometimes are scarcely to be perceived at all—while the physical signs of the disease are also sometimes lessened, although generally not in proportion to the decline in the general symptoms. But in one patient who entered the Pennsylvania Hospital last autumn, under my charge, there were decided crackling, imperfect cavernous respiration, and dullness on percussion at the summit of one of the lungs, together with fever, cough, and emaciation. He was put under the influence of the oil; at first the only kind tried was the dark colored; this, however, produced nausea and could not be taken regularly; the white oil was afterward given; the remedy was continued by Dr. Wood, during his term of duty. In March, 1850, about six months after he had commenced the treatment, he had become much fatter, so as to present the appearance of a person in, at least, the average condition of health; the pain had subsided; the cough was nearly gone; and the physical signs much improved. This was the only case of those treated during my term of service or that of Dr. Wood, in which the amelioration was so decided as to merit the title of cure." [Dr. Gerhard.]

So far as I have used this remedy, I have reason to conclude, that in some cases, it produces a decided improvement in the strength of the patient, changing the expression of the countenance, and removing many of the general and rational symptoms. Undoubtedly its value as a curative agent has been overrated. This, indeed, is almost always the case with every new remedy. But after the excitement has past away, and the calm of reason returns, we can judge better as to its real merits. In one case of incipient phthisis which I treated with this remedy, I am satisfied that it produced such a radical change in the system as to at least

give the appearance of a cure. There can be no doubt as to the phthisical state of the patient before the remedy was prescribed. Belonging to a family in which the scrofulous diathesis prevails, having severe cough, dyspnœa, and the physical signs, a number of physicians, among whom was Prof. Newton, considered the symptoms as clearly indicative of phthisis. The paler variety of the oil was used several months. The amendment was gradual and permanent. The person now, after four years, is as free from phthisical symptoms as before the attack. Such favorable effects, however, are rarely witnessed. In the majority of cases in which the remedy is used, the amendment is but temporary, and the patient sinks under the influence of the disease. Its utility is probably greatest as a preventive, or as a remedy to remove that hereditary tendency to phthisis, sometimes manifested by a voracious appetite, existing coetaneously with emaciation. When the disease progresses slowly, the patient gradually losing flesh, having at the same time slight cough, and alteration of the sounds of respiration at the summit of one of the lungs, we may sometimes succeed in eradicating the disease.

If this be so, cannot this remedy cure consumption in its advanced stage? The answer must depend upon what we mean by a cure. If it be this, that by the use of the remedy when the system is in the most favorable condition for the deposit of calcareous matter, we can so aid the reparative process, as to effect cicatrization, when without the remedy the case would have terminated fatally, then I think we can safely say that, sometimes, it may cure, even in the latter stages. But we never can know how much of the effect is due to nature, and how much to the influence of the remedy. All we can say is this:—that the use of this remedy, when it can be tolerated, places the system in a condition more favorable to restoration than it would be without it.

We may safely conclude that this remedy has no specific influence in phthisis, and that its modus operandi is similar to that of good nourishment. Other kinds of oil probably would have similar effects. But on account of this we should not deprive our patients of all the benefit, whether it be as nourishment, or as medicine, derivable from its administration.

The various preparations of iodine have been considered very serviceable, but their virtues to some extent, have been over-estimated. In the first stage their utility is greatest. When given in large doses they sometimes produce irritation of the stomach. This, however, may be prevented by giving in conjuction with the remedy, sugar. Their operation when favorable, tends to produce absorption, an object always to be sought in the incipient stage of phthisis. Whenever either by remedies or by prophylactic means, we can cause absorption to exceed deposition, a curative process is commenced, whose continuance will result in restoration. Lugol's preparation of iodine is perhaps as good as any. It should be taken in a large proportion of water or half a pint of some demulcent drink, well sweetened with sugar. Various other remedies have been used at different times, to enumerate which would be entirely useless. Prof. C. Newton sometimes administered equal parts of common salt and precipitated carbonate of iron, beat up with an egg. The amount of the two former articles should be from two to three drachms a day.

It is not so much my object to tell what is *not* as what *is* useful in the treatment of phthisis. To me, however, there seems to be a necessity for caution in the use of narcotics in the first stage of this disease. Their operation is directly adverse to the promotion or restoration of the secretions, absorptions, and exhalations of the system. Internal engorgments are increased by their use, even in small doses; and every post mortem examination in subjects destroyed by narcotics, shows a violent state of congestion in the internal tissues of the head, thorax, and abdomen similar to those produced in the internal tissues in most malignant fevers. Dr. Gallup observes, "If compelled to use laudanum, Dover's powders, opiate cordials, or cough drops, I would never attempt a radical cure of phthisis pulmonalis, in any of its varieties." The best possible way to produce freedom from nervous irritation, and quiet sleep, is to restore the circulation of the blood in the most minute capillary vessels. A warm bath, or alcohol and vapor bath, properly administered at bed time, and followed by friction, will secure to the patient more natural repose than all the narcotics in the Materia Medica.

In case a nervine is needed, the cypripedium, scutellaria lupu-

lin, together with the bath will be sufficient. Lobelia tincture combined with either one or more of the above articles, will often produce a still better anodyne effect.

In this disease there is little or no need of cathartics. The tendency of the mucous membrane of the intestines to become tuberculated, and ulcerated, contra-indicates their use. For a mild laxative, a cold infusion of eupatorium perfoliatum, the inspissated gall pill recommended in the article on pleuritis, or some other mild laxative may be administered. The cod liver oil usually has a tendency to overcome costiveness.

2. *To obviate the effects of Tubercles.*—The development of tubercles in the parenchyma of the lungs gives rise to the rational symptoms, to modify the severity of which during the last stage is all that human means can effect.

Cough.—When this becomes very troublesome, entirely preventing sleep, means should be used to allay it. Demulcents freely given, sometimes prove palliative. Of this class of remedies, ulmus, acacia, flax-seed etc., are among the most important. An infusion of one, or all these articles containing a little licorice and lemon-juice, will often be sufficient to assuage the violence of this symptom.

In case the disease is so far advanced as to make any permanent improvement entirely hopeless, sedative and narcotic agents must be resorted to. The dose of these should be as small as possible to secure the desired effect. The anodyne, or sedative, more than the narcotic power should be sought. Accordingly my practice is to combine the acetate of morphia with some form of lobelia, or with inspissated gall, in order to prevent as far as possible the narcotic effect of the opiate. Five or six grains of the latter remedy—the gall—neutralizes the constipating and narcotic effects of one grain of opium, without injuring its sedative influence. Digitalis is sometimes useful to allay arterial excitement, and to mitigate uneasy sensations. Dr. Chapman makes the following statement in relation to this remedy. "As the result of no slender experience with digitalis, I am prepared to state, that the only case of phthisis in which it can be much relied on, is the incipient stage, usually attended with a slight hæmoptysis, small, quick, irritated pulse, extreme debility of the system, short

impeded respiration, and hard, dry, diminutive cough, where evacuent means are precluded." Lactucarium, hyoscyamus, conium, stramonium, and belladonna may be used as substitutes for opiates.

Dyspnœa.—So far as this is dependent upon organic lesion, no permanent benefit can be derived from remedies. But whenever, either partly or wholly, it arises from nervous derangement, nervine, sedative and narcotic remedies must be used. Tincture of lobelia and extract of stramonium, are often serviceable. Occasionally relief may be obtained by the inhalation of vapors—of tincture of conium, or of the smoke of stramonium, or vinegar of lobelia.

Hæmoptysis.—In case this arises from congestion, an anti-inflammatory regimen should be resorted to,—that is the use of lobelia in nauseating doses, the application to the chest of cold alcohol and water, the use of baths to determine the blood to the surface, which in too great a quantity flows into the pulmonary tissues. In case there are no febrile symptoms, a little common salt, taken undissolved into the mouth, and swallowed in that state, will often at once check the hemorrhage. Astringents are often of great utility, especially those containing styptic properties. Tannic acid, kino, rhatany, and matico are highly recommended. Oil of turpentine has been successfully used for this purpose. The best styptic with which I am acquainted is the geranin, the active principle of geranium maculatuin. This in severe cases of hæmoptysis given in doses of ten grains every half hour, exerts a very beneficial influence upon the hemorrhage. To prevent a recurrence of this symptom, an infusion of lycopus virginicus, trillium, and geranium maculatum, is perhaps the best means that can be used. Of the lycopus virginicus, as a remedy for hæmoptysis, Dr. H. Jacobs of Chicopee, thinks very highly.

Pectoral Pains.—These may be removed or assuaged by liniments of various kinds. If the pain is of a rheumatic character, bathing the side in a liniment composed of one part of tincture of capsicum, and four of tincture of arnica, will usually give relief. If of a nervous character, the tincture of aconite in a suitable proportion may be added to the above mentioned compound, and applied to the side. In case the pain is caused by pleuritic

inflammation, other remedies may be applied. But, in my opinion, all powerful irritants, such as setons, tartar-emetic issues, do more injury by producing constitutional excitement, than good by their revulsive effect. If any thing of this kind is used, it should be the irritating plaster, composed of some adhesive mixture and podophyllum, and phytolacca. These latter cutaneous irritants, are most beneficial in those cases in which secondary inflammation, and chronic pleuritis exist with effusion.

All the liniments, and plasters and irritants used in this disease, should not supersede the application of water and alcohol to the chest. Whenever there is much heat, or when the skin is dry, this should be freely applied, the temperature of the application being varied according to the heat of the chest, and the reacting power of the system.

Bronchial Inflammation.—This should be combatted by the use of relaxants and expectorants. That used by Prof. Newton, the compound sirup of sanguinaria and lobelia is very useful. The extract of lobelia pill, should be given to lessen the general febrile action, and proper attention directed to promote cutaneous circulation and secretion.

The expectorant compounds should be varied according to the exigencies of the case. No one formula should be followed in the compounding of medicine for this complication of phthisis. When the symptoms are somewhat inflammatory, the preparation made by Dr. G. M. Nichols, is as useful as any :—

℞	Sirupi glycyrrhizæ	ʒ ii.,*
	Sirupi ipecacuanhæ	ʒ vi.,
	Tincturæ sanguinariæ	
	Tincturæ lobeliæ · a a	ʒ iii.,
	Tincturæ opii camphoratæ	ʒ iiss.
	Tincturæ olei gaultheriæ	ʒ iss.
	Misce.	

*For the preparation of the sirup of glycyrrhiza, no directions are given in the U. S. Dispensatory. It may be prepared by macerating the bruised root in water until a strong infusion is obtained, and then using this, instead of the water, in the formula for preparing the sirupus simplex, in the U. S. Dispensatory.

Dose,—one teaspoonful once in six hours or oftener in case the severity of the symptoms demand. This may be used once in four hours, alternately with a two grain pill of extract of lobelia, if there is high febrile excitement. The proportions of the substances in the formula, should be altered according to the necessities of each individual case.

When the bronchial inflammation assumes an asthenic form, and the febrile symptoms are much less manifest, the relaxant means should for the most part be discontinued, and in their stead slightly tonic, stimulating and balsamic remedies should be used.

Under such circumstances, an expectorant compounded according to the following formula, will better fulfill the indications of treatment:—

℞	Sirupi glycyrrhizæ		
	Sirupi senegæ		
	Sirupi pruni virginianæ	a a	ʒ i.,
	Tincturæ sanguinariæ		
	Tincturæ lobeliæ	a a	ʒ ii.,
	Tincturæ germinum pop. balsamiferæ		ʒ iv.,
	Morphiæ sulphatis		gr. i.
	Misce.		

Dose,—one tea-spoonful once in six hours, or oftener according to the exigences of the case.

With the more stimulating expectorants, tonics may be combined. In anæmic cases, attended with amenorrhœa and gastric irritation the *compound mixture* of *iron* of the Pharmacopœia, may be given either alternately or combined with expectorants.

The inhalation of certain substances is often of some benefit. The vapor of tar, is highly esteemed by some physicians. The air of the sleeping-room of the patient may be impregnated with it by placing a little tar in a cup which is to be immersed in water, contained in another vessel, and heated by a spirit lamp. The common nurse lamp answers this purpose very well. The inhalation of chlorine and iodine, is somewhat irritating to the lungs. With the chlorine the air may be impregnated by letting some sulphuric acid fall drop by drop on chloride of lime. Ammonia has also been inhaled for a similar purpose.

"In order to saturate the system with ammoniacal gas and at the same time to acquire an increment of the electric fluid, the following method of application may be used. Take a piece of quick lime as large as a playing marble and pour over it water sufficient to slake it, so that it will fall into fine powder. Rub this powder in a mortar with a piece of sal-ammoniac—muriate of ammonia—as large as a piece of lime till the articles are finely pulverized and mixed. Put the powder in a small vessel, and pour in a pint of boiling water. Set the vessel in an empty box, so that the vapor can be inhaled at a little distance from the vessel. Put in the water a piece of heated iron to make it boil and throw off vapor. Let the patient inhale the vapor for half an hour." [*Dr. Wm. Tell Parker.*]

Night-sweats and Hectic Fever.—Since the night-sweats are caused by debility of the capillaries, tonic and stimulating remedies are indicated to effect their suppression. Among the internal remedies most efficient are the mineral acids, and especially the sulphuric which is usually employed in the form of elixir of vitriol, or the aromatic sulphuric acid of the Pharmacopœia. From five to fifteen drops may be administered in cold water, three or four times a day. The internal administration of astringents is sometimes of use. Among these, alum, and tannic acid are perhaps as good as any. But the best remedy that can be applied, is a *hot bath*, made excitant by the addition of capsicum, mustard and common salt. It should be followed by brisk friction with a solution of alum in hot brandy in the proportion of two drachms to a pint.

M. Delioux highly recommends the tannate of quinine for arresting night-sweats. The quantity which he prescribes is from seven to fifteen grains daily, dividing it into three or four doses, taken at intervals, the last being taken three or four hours before sleep.

An efficient remedy is the following:—

℞	Acidi sulphurici aromatici	ʒ i.
	Quinæ sulphatis	ϑ i.,
	Misce.	

Dose,—from fifteen to twenty drops, two or three times per day, administered in a wine-glassfull of cold sage tea.

For hectic paroxysms, no remedies are more effectual than sulphate of quinine, and the salicin, the active principle of the salix.

Vomiting and Diarrhœa.—These symptoms are sometimes very troublesome. The vomiting is often one of the most obstinate symptoms, and very seldom yields to the influence of remedies. The amount of food taken at a time should be reduced to a small quantity. Sometimes lime-water gives temporary relief. A sinapism applied over the epigastrium is often serviceable. *Diarrhœa* is another symptom which cannot be remedied permanently by medicine. Dr. Parrish considered a milk diet good to prevent its development. The most benefit that can be derived may be had from the administration of a powder containing two drachms of myricin and one of geranin; or tannic acid given in two or four grain doses once in four hours. With this, alternately, in very obstinate cases, opiates may be administered.

When the debility is great, and there evidently is a large collection of purulent matter in the bronchial tubes to be thrown off by expectoration, and yet not power enough in the system to effect this, the carbonate of ammonia, will prove to be a useful remedy. Wine whey should also be given to sustain the system. For a similar purpose milk punch and wine should be used.

Various other remedies have been used by the profession. Inhaling tubes have been invented the utility of which has not been very great. Forcible expansion of the lungs should be chiefly practised in the early stages, and especially in those cases in which pleuritic effusion has pressed upon one or both of the lungs, and, to a certain extent, destroyed their functions. Jeffries' Respirator has been highly recommended in phthisis. Its benefit arises from the power of the instrument to prevent the entrance of very cold air into the lungs. In cold weather those having irritable lungs need something of this kind in order to prevent the ingress of very cold air, until it is heated. The instrument consists of a fine wire gauze which, during expiration becomes heated by the passing breath, and that heat so received, serves to warm the air of inspiration.

The treatment of the *several varieties* of phthisis should be essentially the same as that laid down in the general treatment.

In the acute variety, remedies should be applied with more vigor, especially when the disease is somewhat inflammatory. The chronic variety needs a longer course of alteratives, and general tonics, nourishing diet, and the temperate use of wine, porter, or ale. In this variety there is more hope, and therefore, the physician should take the greatest care to keep up an equable circulation of the blood, to induce the patient to take exercise, and to associate with cheerful company. These remarks apply equally well to the latent form of the disease.

The phthisis of children should be treated with general tonics and alteratives, combined with the sirup of the iodide of iron. All these means without free exercise in the open air and good substantial food, and a proper attention to the functions of the digestive organs and the cutaneous secretion, will be ineffectual. In fine, the hygienic and dietetic means are of primary importance, the medicinal of secondary.

CHAPTER XVI.

PULMONARY CANCER.

Besides tubercle there is another heterologous deposit in the lungs, called carcinoma or cancer. This very seldom occurs, even among those who have died of the disease in other parts of the body. M. Tanchou states that out of 9118 deaths from cancer, there were only seven cases of cancer of the lungs. Most frequently pulmonary cancer has its seat in the cellular tissue. The encephaloid variety is most common. Out of twenty cases, sixteen were of this variety; three encephaloid and scirrhus united, one scirrhus and colloid.

Sometimes the cancerous matter is deposited in the cellular tissue of the anterior and posterior mediastinum, and forms a tumor which presses upon contiguous structures, upon the trachea, great blood-vessels of the heart, and upon the œsophagus. The tumor sometimes grows to so great a size as to distend the parietes of the chest.

When the disease is located in the pulmonary tissue, it converts the parenchyma of the lung into its own substance. The effect of its extension, is to compress adjacent textures, and to produce an actual atrophy of the diseased lung. The progress of the disease may excite secondary inflammation; sometimes implicating the pleura. Cancer, like tubercle, sometimes has a period of softening, during which it not unfrequently excites bronchitis. But the softened masses, unlike tubercles, are seldom expectorated.

The duration of cancer of the lungs is usually about fourteen months. But it may terminate life in two months, or may linger in its progress until years pass away. Cancer of the mediastinum seldom terminates so speedily, as that of the lungs; its average duration being sixteen months. Pulmonary cancer is divided into two varieties: cancer of the lungs, and cancer of the mediastinum.

Pathology.—The general appearance of encephaloid disease, is that of a brain-white solid of varying consistence, with a pinker hue than that of tubercle, occurring in tumors sometimes encysted, or infiltrated through the tissue of the lung. Sometimes, the tumors are soft, and cellular; sometimes tough, resembling the pancreas in appearance. A predominance of the vascular and cellular structure, with patches of extravasated blood, constitutes the fungus hæmatodes. Encephaloid matter infiltrated into the parenchyma of the lung, in some cases, presents an appearance intermediate between those of tuberculous and hepatized consolidations. Sometimes melanosis is combined with encephaloid disease. The black matter may occur infiltrated in a natural structure or in distinct tumors or deposits of an irregular cellular organization. Care is necessary, in order not to confound with melanosis, the accumulations of black, pulmonary matter, which take place to a great extent in the lungs of old people, especially among the inhabitants of large towns. This black appearance is supposed to be caused by the inhalation of particles of dust, of a carbonaceous nature from the atmosphere.

Diagnosis.—In the commencement of this disease there are no very manifest symptoms developed. There may be a little dyspnœa, slight cough, and a little expectoration. With the advance of

the disease the symptoms become more marked, the cough is increased, the expectoration is more copious, and there is an almost constant pain in the chest. Hæmoptysis, too, may occur, in consequence of the lesion of the pulmonary vessels. The constitution sympathizes with the local disease; the pulse is excited, there are emaciation, increasing debility, and a peculiar straw color to the countenance, and the superficial veins become enlarged. Dropsical swelling is observable in the extremities, and the system gradually sinks under a low, asthenic form of inflammation—going on in the chest or abdomen. The cancerous deposit, gives rise to dullness on percussion, sometimes to bronchial respiration, and vocal resonance, or to a ronchus and mucous rale. The cancerous disease tends to produce contraction of the affected side, which, of course, is porportioned to the extent to which the disease has progressed. The pulmonary tissue becomes condensed and the bronchi sometimes are obliterated, in which cases there will be no respiratory murmur.

Cancer of the Mediastinum.—Pathology.—The growth of the tumor may be so great as to compress the vessels of the heart, and induce signs of valvular disease, or by retarding the free circulation of the blood may produce œdema, or may fill so large a space in the chest as to cause the physical signs of an empyema. These cancerous tumors vary in size, sometimes weighing several pounds. They present the three forms of cancerous growths.

The diagnosis of cancer of the mediastinum is difficult. There are only a few distinctive symptoms, among which are the straw color of the skin, the œdema of the face, and upper extremities, a tendency to anasarca in the lower limbs; cancerous tumors on other parts of the body, the contraction of the side accompanied by bronchial respiration, heard over it, instead of the dilatation so characteristic of hydrothorax, and empyema.

Phthisis usually affects the upper parts of the lungs: cancer may attack any portion, although it oftener affects the upper portions, than the lower. Neuralgic pain often extends down the arm, which is not the case in phthisis. The pulse is also less excited, hectic seldom severe, cavities are not formed. Tubercles in general before the case terminates fatally, affect both lungs,

while cancer usually affects one only. Cancerous tumors are usually larger than those of a tubercular nature. This disease may simulate thoracic aneurism or even disease of the heart. This results from its location near some large blood-vessel, in which case it may obstruct the flow of blood, and hence, produce those physical conditions which excite the bellows murmur. Its recognition under such circumstances must depend upon the existence of the cancerous tendency in the general system. The heart is not so enlarged as in hypertrophy. From aneurism it may sometimes be distinguished by its location:—aneurism being on the course of the aorta, and being attended by pulsation, a thrill and bellows murmur; cancer is not prone to give rise to these phenomena. It is evident, however, that nothing very definite can be determined by the symptoms in those cases in which complications exist; and under the most favorable circumstances the diagnosis must be uncertain.

The Prognosis may be readily inferred from the fatal results following cancerous disease in other parts of the body.

The Treatment must be almost wholly palliative; the great object is this; to remove urgent symptoms by sedative and relaxing agents. Complications should be treated according to the nature of the disease with which it is associated. Dyspeptic symptoms should be removed by gentle emetics of lobelia, and by tonics. To purify the blood the best alteratives may be used in conjunction with other means, to produce a normal action of the cutaneous vessels.

DIVISION II.

DISEASES OF THE HEART.

Formerly, diseases of the heart were very imperfectly understood. In their organic forms they have been considered very rare, and their results almost always fatal. Very frequently they have been confounded with other diseases of the thorax, such as pulmonary congestion, and hydrothorax, and sometimes with those of other parts of the system, such as dropsy and apoplexy, and various other affections. By the discoveries of Corvisart, Laennec, Louis, Cullen, and Bouillaud, in France; of Hope, Williams, Latham and Stokes of Great Britain, and of Dr. Pennock of this country, the nature of cardiac diseases, and their diagnosis and treatment, are now made as intelligible as that of the majority of other diseases.

Before the discovery of auscultation, diseases of the heart could not without great difficulty be distinguished from those of the lungs. But physical exploration, and pathological anatomy have to a considerable extent removed the impediments to their diagnosis. The investigations into their causes have also produced many valuable results, and have clearly shown, that in a majority of cases especially in young persons they arise from inflammation.

General symptoms.—The pulse is nearly synchronous with the pulsation of the heart, following it at a very slight interval. Subject to all the irregularities of the cardiac pulsations in relation to duration and irregularity of beat, it often enables us to detect the derangement of the central organ of the circulation.

But it is not always a sure indication. Intermission of the pulse may exist, when there is none in the heart. The ventricular contraction may be too feeble to transmit the impulse along the arteries of the extremities. The quantity of blood in the heart may be so small as not to cause vigorous contraction, and a feeble, irregular pulse may be the consequence. Irregularities of

the pulse independent of cardiac disease may exist for a long time, but cæteris paribus they are more apt to occur in connection with it, than independent of it.

Dyspnœa is another symptom of cardiac disease. Sometimes it is partly dependent upon nervous derangements, but more often upon direct interference with the functions of the lungs, either by pressure upon that organ, or effusion into the parenchymatous tissue or pleural sac.

Pain.—In disease of the heart, painful or disagreeable sensations often occur in the cardiac region. Sometimes it is very acute, felt near the left nipple or at the extremity of the sternum. This is sometimes attended with dyspnœa; sometimes extending across the chest and passing down the left arm.

Palpitations, which are pulsations so violent as to be troublesome to the patient, are often experienced in disease of the heart. They arise from nervous irritability in which case they are often the cause of needless fear to the patient, and sometimes of perplexity to the physician. This symptom, unless attended with other indications of cardiac disease should not be much depended upon;—for when alone, it presages no certain organic derangement, and should excite suspicion only when it continues for a long time.

The *secondary* symptoms resulting from cardiac disease are numerous, and such as would naturally result from irregularities of the circulation of the blood. The blood may be driven with too great force into the brain, as in hypertrophy of the left ventricle, into the lungs in a similar condition of the right ventricle, or it may be retarded in its return from the abdominal viscera by impediments in the right side of the heart, and finally it may be feebly propelled throughout the entire system in consequence of the cardiac obstruction. Hence, congestions in one organ, and anæmia in others; hence apoplexy, vertigo, epistaxis and hæmatemesis occur. These symptoms vary according to the nature of the cardiac disease, the constitution of the patient, and various other modifying circumstances. If active congestion is present, we have the turgid, distended state of the blood-vessels, the prominent eye, the flushed and swollen face; if the passive, then we have the purple lips, livid complexion, and the general tendency

to œdema. The whole heart is seldom diseased at once. It may be confined to a single valve or cavity.

Causes of Heart Disease.—Inflammation, attacking the membranes of the heart, whether external or internal, becomes a frequent cause of cardiac lesions. Pericarditis has but little tendency to produce organic changes, while endocarditis is very prone to produce such a result. Of all the causes tending to produce disease of the heart, acute articular rheumatism is the most frequent. More than half the cases of this variety of rheumatism, according to Dr. Gerhard, are more or less complicated with cardiac disease.

There are other causes, which, although not so important as the one above mentioned, are, nevertheless, worthy of notice. These are violent nervous excitement, sudden injuries inflicted by a strain, a sudden propulsion of the blood into the heart in an abnormal quantity and with great force, advanced age, ossific deposits in the valves or internal membranes.

Functional diseases of the heart are produced by causes as various as those of all nervous disorders. In general anæmia, nervous irritability, gastric derangements, and a suppression, or interruption of the menstrual discharge, give rise to violent palpitations. In young men, particularly those of a nervous temperament, of studious habits, accustoming themselves to excess in study, the same series of symptoms is sometimes developed.

Termination of Heart Disease.—Inflammatory affections of the heart may terminate in recovery, and the patient experience a complete restoration to health. Dr. Hope remarks:—"Many think that the expectation of effecting an improvement in the treatment of diseases of the heart, is chimerical; and they think so, because, not being accustomed to recognize the diseases in question before they have attained an advanced stage, they are preoccupied with the old and popular idea of their incurability. To such it might, perhaps, be a sufficiently philosophical answer to reply, that an improved knowledge of the nature and causes of a disease, must alone necessarily lead to an improvement in the treatment, and that therapeutic weapons are dangerous, when wielded in the dark. But here we may go much farther; we may say that, by the improved means of diagnosis, the maladies under

consideration, may be recognized, not only in their advanced, but in their incipient stages, and even, when so slight as to constitute little more than a tendency. We may say, on the ground of incontestable experience, that, in their early stages, they are, in a large proportion of instances, susceptible of a perfect cure, and that, when not, they may in general be so far counteracted as not materially, and sometimes not at all, to curtail the existence of the patient. We may, accordingly, predict that the term "disease of the heart," which at present sounds like a death knell when uttered by the physician, will hereafter become by familiarity, not more alarming than the term asthma, under which it is frequently disguised."

This description of the curability of disease of the heart, is somewhat too hopeful. Chronic organic affections in general do not terminate so favorably. They may continue for years, not increasing in severity, until some exciting cause adds new force to the disease and causes sudden death. When once the disease has commenced on the internal membrane, it is prone to extend; one difficulty leads on to another; hypertrophy produces valvular disease and inflammation of the endocardium. So that, when endocarditis in the young ends in apparent recovery from the acute attack, it leaves behind in most cases a disease in the valves which, by impeding the circulation of the blood, produces an unnatural action of the heart, and at last terminates in disease of the muscular tissue.

Functional disease of the heart is seldom dangerous, except in those cases in which it generates organic affections. The *influence of age* is considerable in the production of cardiac disease. Cardiac affections are usually slow in their access, and consequently they are more often observed in the old than in the young. They also depend for their production, upon that feeble circulation of the blood arising from deficient nutrition, which is more frequent in the aged. On account of their greater exposure, males are more subject to organic diseases of the heart than females. Their frequent muscular exertions both in labor and amusement, tend to produce permanent lesions. The functional derangements of the heart, are more common in females than in males, because they are more subject to symptomatic affections, on account of their greater nervous irritability.

General Diagnosis.—The nature of the origin of the disease, has important bearings on its diagnosis. If inflammation of a rheumatic character preceded the attack, if disease of the heart is hereditary, or if the gouty or rheumatic diathesis is fully developed, then, the existence of organic affections of the heart should very strongly be suspected. But if, on the other hand, there were peculiar marks of deranged nervous action preceding the cardiac symptoms, a probability exists, that the case is one of functional, not of organic disease. To this probability is added more evidence, if the patient presents strong signs of a nervous temperament.

Pain in the region of the præcordia, and a sensation of weight and stricture there felt, are indications of this disease; likewise, orthopnœa, fullness of the cervical veins, increased dyspnœa in ascending a hight, blueness or lividity of the lips. A thrilling pulse, and œdematous effusions are also somewhat characteristic.

General Prognosis.—In organic disease of the heart the prognosis is unfavorable. The effects of extensive disorganization of the valves, and of the internal membrane of the heart and aorta, and of hypertrophy and dilatation must from the nature of all such changes be attended with danger to life. In acute inflammatory cases, the proper application of appropriate remedies generally gives relief; sometimes very soon, sometimes after a longer period. In those cases which seem to presage a fatal termination, the symptoms sometimes abate by degrees, until the disease is finally, so far as external phenomena can be perceived, verging on towards a cure. The prognosis then must depend upon the character of the modifying circumstances, and not upon any one symptom exclusively.

CHAPTER I.

EXAMINATION OF THE HEART.

In making an examination of the heart, several points need particular attention. The most important of these are its position

size, impulsion, sounds, rhythm, and the mode in which the heart acts, whether regularly or spasmodically.

Position of the Heart.—The heart lies in the centre of the chest, inclining a little to the left side and to the lower portion of the sternum. Its direction is oblique from right to left. Superiorly, it extends to the intercostal space between the third and fourth ribs; inferiorly to the base of the thorax, or to about the ninth dorsal vertebra. To the left it extends nearly or quite to the nipple, to the right it extends a little beyond the edge of the sternum. The apex is between the cartilages of the fifth and sixth left ribs, at a point about two inches below the nipple, and one inch on its sternal side. The base of the ventricles corresponds nearly with the middle of the third rib. According to Dr. Pennock, the only fixed and stationary point is at the valves of the aorta; other parts being movable more or less around that as a centre. And, therefore, the exact situation of those valves—the aortic semilunar—becomes of some importance. A needle piercing the middle of the sternum opposite to the middle of the cartilages of the third ribs, and perpendicular to the plane of the sternum will pierce them. A needle introduced perpendicular to the tangent of the curved surface of the thorax, between the cartilages of the second and third ribs, half an inch from the left margin of the sternum, pierces the semilunar valves of the pulmonary artery.

"The septum between the ventricles, coincides with the osseous extremities of the third and fourth and fifth ribs, and on the fourth rib is midway between the left margin of the sternum and nipple." The positions of the orifices of the aorta and pulmonary artery, of course, correspond very nearly with those of their valves, the valves being situated a little superior. The left auriculo ventricular orifice, is under the lower edge of the cartilage of the third rib, and a little to the left of the median line. The memory of these facts is very necessary in the diagnosis of valvular disease. The heart is in contact with the diaphragm below, and the lungs, on its right and left sides overlap it, leaving a small triangular space uncovered, of variable dimensions, under the cartilages of the fourth and fifth ribs of the left side.

Size of the Heart.—Much care has been taken to obtain by accurate observation the exact size of the heart. Laennec compared its size with that of the fist of the individual. This, though a simple comparison, and one which may always be easily made, is by no means accurate. Others have with great precision, weighed the heart, and brought forth the conclusion that its weight is about seven or eight ounces. It is always greater in males, than in females.*

Bizot in order to arrive at a still greater degree of precision, has adopted the method of measuring the heart. His conclusions are, that the heart increases in size as age advances, that its size corresponds with the breadth of the shoulders, and not with the height of the individual, that it is larger in males than in females.

To ascertain the normal size of the orifices, is very important. Dr. Taylor has suggested a method of very easy application. The mitral orifice just admits according to his measurement, the first two fingers of the hand; the tricuspid orifice, the three first fingers. This, like the comparison of Laennec, is not accurate, but is of some practical utility, where great precision is not necessary.

In order to ascertain whether the valves will close the orifices the experiment suggested by Dr. Swett, is useful and conclusive. Having removed an inch or two of the aorta and pulmonary artery with the heart, he then makes a transverse section of the heart near the apex, so as to open the cavities of both ventricles. The heart being suspended by hooks passed into three different points of the aorta, so as to keep the vessel open, water is poured into it. If the valves are in a perfectly normal condition, they will shut, completely closing the orifice against the passage of the liquid. The same experiment may be successfully tried with the pulmonary artery; likewise, with the mitral valve, it is equally satisfactory, but not completely so with the tricuspid. Through

*The normal heart may be assumed to average for the whole life, above puberty, about 9 oz. in absolute weight, and 8½ oz. in bulk, for the male; and 8 oz. or a little more in weight, and 7½ oz. or a little more in bulk for the female; and to bear after death, to the weight of the person, for the male, the proportion of about 1 to 160, and for the female, of 1 to 150. [Clendinning, Croonian, Lectures for 1838.]

this latter valve, Dr. King of London contends that regurgitation even in health, takes place.

The size of the heart is modified by disease, and consequently the physical signs, especially percussion, are changed.

Impulsion.—The beating of the heart may be felt by placing the hand upon the chest, as nearly as possible over the apex of the organ. The impulsion is caused by the striking of the apex against the ribs, and is generally supposed to arise from the contraction of the ventricles, and to be synchronous with the systole. The truth of this opinion, however, is disputed by Dr. Alfred Stille. On the contrary he contends that the impulse of the heart is synchronous with, and produced by the diastole of the ventricle. [Vide Stille's Elem. Gen. Path. p. 319.] The impulse is given almost exclusively by the apex of the heart. The sensation is, therefore, sharp as if caused by the quick stroke of a small hammer. Exercise or nervous irritability, increase its violence. Hypertrophy also tends to make the impulse greater, and by the increase of the bulk of the heart, extends the shock over a much greater surface.

Great muscular debility, arising from asthenic diseases, may cause the impulse of an hypertrophied heart to be less powerful than natural. Its degree varies even in health, according to the activity of the circulation. In those of a phlegmatic temperament, and the corpulent, it is often almost imperceptible, while in those of a nervous temperament, and not fleshy, it is very strong. In pregnancy, too, it is subject to great variation. It corresponds with the beating of the arteries, both being dependent upon the same cause. The radial pulse, as well as the pulse of the larger arteries, is nearly synchronous with the beating of the heart, there being a very short interval between them. The number of pulsations bears a relation to the number of respirations, the former being to the latter as four and a half to one.

Irregularities in the cardiac pulsations are sometimes observed in healthy persons; and this phenomenon often ceases when the patient is laboring under an attack of disease, and returns again with the return of health. A very feeble systolic contraction occurring in connection with a stronger one, may give rise to intermissions in the radial pulse when there is none in the heart. The

heart, however, is subject to true intermissions. Its impulse is much changed by disease;—sometimes becoming very frequent, strong or weak, or frequent and irregular. Hypertrophy is thought to augment its force; in some cases to such a degree as to make the impulse seem like the stroke of a hammer within the chest. Debility diminishes it, and the removal of the heart from the surface of the thorax by pleuritic effusions or by other similar causes. The location of the impulse is changed by any cause which can displace the heart.

Its character varies greatly. Among these common variations is the "short, sharp, quick stroke of irritation which is wholly different from mere frequency of beat; the former referring to the individual pulsations, the latter to their succession. Instead of resulting from the striking of the apex of the heart against the ribs, the impulse is sometimes produced by the whole organ rising up, as it were, under the hand, and giving rise to the sense of a slow heavy motion, rather than of a blow. This happens in dilatation and hypertrophy."

In relation to the repetition of the impulse, it may become so frequent that it cannot be counted, even exceeding 200 strokes in a minute, or may be reduced even as low as 15 or 20, in the same length of time.

The relation of the successive impulses to each other, is liable to excessive irregularity. Sometimes a stroke is now and then omitted, either at stated intervals or quite irregularly. In such cases, the pulsation is said to be intermittent. Occasionally, it is remittent, one or several strokes being more feeble than those which precede and follow.

"Not unfrequently the rapidity of succession varies greatly; the pulsations being now very short and rapid, almost running into one another, then again prolonged, slow, and distinct; and all these diversities may be combined in the same case.

"The double or triple impulse which is sometimes in quick succession, may be owing to as many partial contractions of the ventricle, before the full systole is accomplished. Some have supposed that the diastole is concerned in these irregularities, as there is at that period a sudden and apparently active swelling out of the ventricle, which must make some impression upon the parie-

tes of the chest. It has been maintained, that there is in health a double impulse of the heart, scarcely sensible in its ordinary state, but becoming obvious in excitement, the first impulse being dependent upon the systole, the second, much feebler, upon the diastole, and felt between the second and third ribs." [Bellingham and Sibson, Lond. Med. Gaz., March 1850, p. 445.]

"Palpitation sometimes gives the peculiar thrill called fremissement cataire," or the purring tremor. It is so called because it gives to the hand when applied to the thorax, that peculiar sensation felt on the chest of a cat while purring. Over aneurisms of the arch of the aorta, it is most distinctly perceived In valvular diseases it is also felt. It may be excited in nervous persons by agitation of mind. Unless the origin of this symptom can be traced to that cause, serious obstruction to the passage of the blood through the heart should be considered as very probable.

1. Physical Signs.—*Signs by Inspection.*—Inspection alone is of little value in the diagnosis of diseases of the heart. In health a slight movement over its apex may be seen. In disease sometimes this becomes very manifest, being visible through the clothing. This abnormal movement sometimes extends to the carotids and jugulars, and even the body seems to be jarred by the cardiac impulse. But the difficulty is, to distinguish between the causes of the palpitation, whether they arise from organic lesions or from functional derangements. In cases of great effusion into the pericardium, the external form of the chest may be somewhat altered. In the præcordial region a prominence is then often seen, and the left nipple is a little more projecting than the right.

2. *Signs by Percussion.*—"In percussing the præcordial region, the best pleximeter is the fore finger of the left hand, and the best hammer, the first two fingers of the right hand."

Over that part of the thorax with which the heart is in contact, there is dullness on percussion. But as the margins of the lungs extend over a part of the surface of the heart, the percussion is modified, as we recede from the portion of the heart in contact with the chest, becoming gradually less and less dull, until the normal resonance of the parts of the chest over the lungs is heard.

This change is gradual; so that the precise boundary line cannot be marked out by the sounds of percussion.

The sound elicited by percussion over the præcordial region, varies according to the position of the body, the degree of expansion of the chest, and the nature of the diseases which affect adjacent organs.

Before deducing any practical inference, we should, therefore, take into consideration all these circumstances. The dullness is increased by pronation of the body, decreased by supination. Certain affections directly interfere with the indications on percussion. On the one hand, pleuritic effusion, hepatization of the lung, tumors and enlargement of the left lobe of the liver increase the dullness; on the other, emphysema, pneumothorax and great gastric flatulence, decrease it. After making proper allowances for all these conditions, percussion may be of practical utility by indicating the existence of hypertrophy of the heart, or of effusion into the pericardium. But how does percussion indicate the existence of that condition of the heart, or of hydropericardium?

"In the natural state, the extent of dullness does not exceed a space of about three inches in length, measured along the sternum, and about two and a half inches laterally; that is, the dullness extends to a short distance within the nipple, and at about the middle of this space, just at the left margin of the sternum, it amounts in most persons almost to perfect flatness. The greatest dullness of sound extends over a breadth of one inch and a half to two inches; that is, over the space which the lung does not overlap; so that there are two sounds of percussion,—one nearest the sternum which is flat, and the other more external, which is simply dull. The difference depends upon the percussion being made in the latter case over both the tissue of the lungs and heart." [Dr. Gerhard.]

Now if the heart be enlarged, or if there is any effusion into the pericardial cavity, the dullness is increased in the direct proportion to the increased enlargement. When the dullness results from hypertrophy of the heart, it is more rounded in shape,—the heart preserving for the most part its original form—than when it depends upon pericardial effusion. In the latter case the pericardium, though distended with liquid, still preserves its pyramid-

al form, the apex being towards the upper part of the chest. With these preliminary remarks, I now answer the question above proposed. Hypertrophy is indicated by the extension of dullness over a space larger than that over which it is perceptible in health, and also by the form of that space which by percussion, and perhaps in some cases, by inspection also, is proved to be nearly round. Pericardial effusion is indicated by the abnormal extension of dullness, and by the pyramidal form,—apex upward, base downward,—of the space over which the dullness is perceptible.

3. *Signs by Auscultation.*—The action of the heart gives rise to sounds which, though not audible in health, are so by the ear when applied to the chest. Some persons especially after exercise can hear the beating of their hearts. In making examinations of this organ, a stethoscope should be used, whenever the sound from a very limited space is desired. But the ear should be applied directly to the chest, whenever we wish to detect all the slightest murmurs. In order to prevent the interference of the pulmonary sounds we should, during a very limited interval, direct the patient to stop respiration. Dr. Swett prefers the solid stethoscope.

During the examination the position of the patient should be fixed and erect, and the præcordial region fully exposed. In females a very thin covering may be allowed.

The sounds of the heart may be divided into *normal* and *abnormal.* These in some cases so blend together, as to make it difficult to detect the precise limit of the former, and the beginning of the latter. A full acquaintance with the former, must always precede all practical knowledge of the latter. And I cannot too strongly urge the necessity of studying the physical condition of the heart in health, and of becoming familiar with all the phenomena of its normal action, before beginning the study of the diseased heart.

1. *Normal Sounds.*—The normal sounds of the heart are two: the first—synchronous with the impulse, and, in vessels near the heart, with the pulse—is duller and longer; the second is shorter and clearer. The latter immediately follows the former; and after the second, an interval of silence succeeds. The first sound, heard during the systole, and hence often called systolic, is most

distinct over that part of the chest in contact with the ventricles. The first sound has been compared to that produced by jerking a cord as thick as a swan-quill.

The second sound, accompanying the dilatation of the ventricles, and the contraction of the auricles, and hence sometimes called the diastolic, bears a close resemblance to that produced "by lightly tapping with the soft extremity of the finger of one hand near the ear, the knuckle of a bent finger of the other hand." It is heard most distinctly over the semilunar valves; that is "upon the sternum opposite to the inferior margin of the third rib, and thence for about two inches upwards, along the diverging courses of the aorta and pulmonary artery respectively, the sound *high up* the aorta proceeding mainly from the aortic valves, and that *high up* the pulmonary artery, being mainly from the pulmonic."

The causes which produce the first sound, have been the subject of discussion, and much theorizing. Of their true nature, Laennec was comparatively ignorant, and Magendie broached a theory, not founded on facts. Mr. Turner, of Edinburgh, first pointed out the true connection of the sounds with the movements of the heart. He maintained that the first sound occurred during the systole, the second during the diastole. Magendie maintained, that the first sound was caused by the striking of the heart against the ribs; Rona net, that the two sounds were valvular, the first caused by the tension of the auriculo-ventricular valves; the second by that of the semilunar or sigmoid valves. In relation to the cause of the second sound, nearly all pathologists agree with Ronannet; in relation to that of the first sound, authors, in general, agree. that it is compound, the result of several causes, among which the principal is the muscular contraction of the ventricles.

That muscular contraction generates sound, is not a matter of theory, but of fact. Dr. Wolloston and many others, have demonstrated it. A stethoscope, applied over a contracting muscle, brings sound to the ear. By applying the stethoscope to the heart of a calf, taken from the body after sensation is destroyed, but before the animal is quite dead, a sound may be distinctly heard. A cause of minor importance, is the friction of the blood against the semilunar valves.

The other causes, adduced by authors, the tension of the auriculo-ventricular valves, the striking of the heart against the ribs, the auricular contractions, may have some tendency in conjunction with the more important causes, to produce the systolic sound.

The second sound of the heart is simple, and caused, as is fully demonstrated by experiments* by the tension of the semilunar valves of the aorta and pulmonary artery during the diastole of the ventricles.

"From the commencement of the first sound until its return, a little less than a second of time is occupied. The duration of the several parts of the series which constitutes what may be called a beat, is the rhythm of the heart. The *beat*, as described by Laennec, consists of three periods:—1. The ventricular systole which occupies nearly half of the time of a whole beat.—(Mr. Bryan says a third only.)—2. The ventricular diastole occupies a fourth; or at most a third.—3. The interval of ventricular repose occupies a fourth or rather less, during the latter half of which the auricular systole takes place.—[*Hope on the Heart.*]

The first and second sounds together are compared by Dr. Williams, to that produced by the pronunciation of the monosyllables *lubb dup*. Dr. Bowditch prefers this alteration, *lubb tuk*. The French have used a very wrong sounding word *tic-tac*, to represent the double sound.

In duration, extent and loudness, the sounds of the heart differ in health. It is probable that the sounds produced by the two ventricles are not identical; but since the contractions of both sides of the heart are synchronous, nothing very definite in relation to this can be easily determined.

The quicker, and more energetic the ventricular contractions, the louder is the sound. The thickness of the thoracic parietes has a modifying influence. The loudness of the ventricular contractions, cæteris paribus, is inversely proportional to the thickness of the parietes of the chest.

By the influence of mental emotion, or bodily exertion, the interval of repose may sometimes be almost annihilated. Hepatiza-

*In the New York Journal of Medicine and Surgery for April, 1840, is a detailed account of experiments establishing the mechanism of the sounds of the heart.

tion of the portions of the lung contiguous to, and overlaping the heart may cause its sound to extend over a space unnaturally large.

Abnormal Sounds:—The sounds of the heart may be altered in character, or increased in intensity. The alteration may consist in a slight abnormal harshness, or the natural tone may be wholly changed. The first sound is most frequently altered. A nervous temperament may increase its loudness, or a hardening in its muscular structure, conjoined perhaps with slight obstruction of the semilunar valves. In the former case, the symptom is temporary, in the latter it is continuous. The phrase "increased loudness," and the word "roughness," are, as used by Dr. Gerhard, nearly identical in meaning. "If the roughness is increased," he continues, "it passes into the bellows or rasping sound. The former of these is less marked than the latter. A bellows sound is generally described as a prolonged and purring sound, usually heard in the first sound of the heart, and, therefore, produced chiefly by muscular contraction, although it may also arise from alterations at the auriculo-ventricular valves, in which case it occurs during the diastole of the heart." The term *bellows* has been applied to this sound on account of its resemblance to that produced by blowing strongly into a bellows. It differs in the degree of its harshness. In its simplest form it is "slight, short and breezy," the slightest prolongation of either sound of the heart (*bruit de souffle, Fr.*). A still greater degree of harshness constitutes the *pure bellows sound* (*bruit de soufflet, Fr.*). Next is the *filing* or *rasping* sound, (*bruit de rape, Fr.*,) resembling the sound of a rasp forced through soft wood. The loudest and roughest of all is the sawing sound (*bruit de scie, Fr.*).

Dr. Pennock very properly suggests, that as sawing is a double motion, the name should be restricted to the double murmurs produced by the alternate motion of the heart. The *bellows sound* may be short, or so continuous, as to nearly fill up the space between the impulses. This sound in its pure form may exist without any organic change; pressure upon a vessel, or any pathological change causing sufficient contraction to alter the direction and velocity of the blood in the arteries, and to cause it to

be reflected upon the sides of the blood vessels and produce vibrations, gives rise to its development. By anæmia, or chlorosis, or excessive blood-letting, this sound is liable to be produced. A watery state of the blood is favorable to the production of vibratory motion. Its particles in that condition move so readily upon each other, that a little pressure of the stethoscope upon an artery, or even excitement, very often gives rise to the bellows murmur. "When the bellows sound depends upon an hypertrophied ventricle urging the blood rapidly through a narrow or non-dilated semilunar valve, or driving it back through a dilated auriculo-ventricular opening, it is more persistent, more uniform, and is less musical, but more harsh than when it arises from a mere nervous disorder; the same character is found when the sound is heard during the diastole from regurgitation through the semilunar, or contraction of the auriculo-ventricular valves."

The variety of the bellows sound termed *filing* or *rasping*, is produced by the inequalities of the surface over which the blood flows. These inequalities arise from depositions of lymph, excrescences of various kinds, osseous and cartilaginous productions. This sound indicates an organic disease in the valves. Another cause of these cardiac sounds is some defect in the valves. Such as thickening, dilatation of the orifice, or loss of substance, preventing their complete closure, and thus inducing regurgitation. This variety of bellows murmur is scarcely ever heard during diastole, for its production requires considerable force in the current of blood,—more force than regurgitation through a narrow orifice produces. But when the aorta is much dilated, the reflux of the blood during the ventricular diastole, is almost as powerful as its forward current during systole. And the blood, passing both forward and backward over the irregular surface of the diseased valves, causes the sawing sound (*bruit de scie*) instead of the rasping. This sawing sound is a diagnostic sign of aneurism of the aorta.

The degree of softness or loudness depends upon the force of the circulation of the blood. The systolic ventricular murmurs are louder than the diastolic. The key or tone, according to Dr. Hope, is higher or lower, according as the sound is generated at a less or greater depth, by a less or greater force, or in a less or

more contracted orifice. Roughness of sound is proportionate to the irregularity in the surface producing it. Dr. Hope found the musical note most frequently an attendant on regurgitation. By changing the force of the heart's action, the sounds are made more audible, and their character is altered. A slight *bellows* murmur may be *roughened* by any excitement of the heart which increases the rapidity of the current. The quantity of blood, according to Dr. Williams modifies the murmurs, increasing and prolonging them when excessive, and rendering them loud and short when defective and attended with excited action of the heart.

To ascertain in which of the valves the murmur originates whether it is dependent upon obstruction caused by the deposition of some morbid product around the orifices of the heart, or upon a deficiency or imperfect closure of the valves, is very important.

This desirable information as to the valves affected, may in most cases be obtained by carefully noticing the seat of the murmur, as perceived by the stethoscope.

"When the sound is loudest on the sternum, immediately below the insertion of the third rib, and thence extends upward for about two inches along the course of the great vessels, it may be considered as having its source in the semilunar valves. If the sound be perceived most distinctly along the course of the ascending aorta upon the right, it is probably seated in the aortic valves; if along the pulmonary artery on the left, it is in the pulmonic valves. When the murmur is most distinct over that part of the chest on which percussion is dull, that is, where the ventricles are in contact with the walls, it may be inferred, that it is generated, either in the mitral or tricuspid valve; in the former, when the point of greatest loudness is a little to the right of the left nipple and an inch or so below it, in the latter, when the analogous point is on or near the sternum in the same horizontal line."

The solution of the second question, whether the sound depends upon contraction or any other obstruction of the valvular orifice, or whether upon an abnormal condition of the valves themselves, causing their imperfect closure, is mainly effected by the observation of the *course* of the sound, the relation of the

time of its occurrence to the time at which the ventricular systole and diastole take place, and by the character of the sound itself.

The *course* of sound in moving liquids, as in the atmosphere, is in that direction in which the current flows. Confining my remarks, for convenience of description to the left side of the heart—let us suppose that there is contraction of the semilunar valves, or any other obstructing cause at the orifice of the aorta, or that the mitral valve is not in a normal condition so as to produce a closure of the auriculo-ventricular orifice. In either of these physical conditions, the sounds,—in the former case arising from a contracted orifice, in the latter, from imperfect closure,—will be made during the ventricular systole. What then does the existence of murmurs during systole indicate? It may in the first place indicate contraction of the semilunar valves, or of the orifice at which they are located; or secondly, regurgitation through the auriculo-ventricular opening into the auricle in consequence of deficiency of the mitral valves. But how distinguish the one physical condition from the other? In the former, the sound is heard along the course of the large vessels, the aorta and pulmonary artery; in the latter the sound does not extend up those vessels. Let us now suppose an opposite physical condition of the valves and orifices. Suppose a dilatation of the aortic orifice, or an insufficiency in the aortic valves to exist, or suppose that the mitral valve, instead of being unable to produce complete closure, to be so contracted as not easily to open, or the auriculo-ventricular opening to be obstructed, what sounds will then be produced during the ventricular systole? Evidently none. And why? Because the mitral valve very readily closes during ventricular systole, and the passage into the aorta is not obstructed. What sounds occur during ventricular diastole? and what do they indicate? As the blood regurgitates from the aorta, it produces some variety of the bellows murmur; in case the aortic orifice is dilated, rough, and irregular it may produce the *sawing*—bruit de scie—sound. If the lesion be at the mitral valve, producing obstruction to the ingress of blood into the ventricle, the bellows murmur is heard over the left ventricle, but it is more obscure and feeble.

The same orifices may at the same time be contracted, and ad-

mit of regurgitation, and more than one orifice may be simultaneously affected. Hence the blowing sound may be either single or double; single when produced at one orifice, double when at two orifices. The orifices of the left side of the heart are much more frequently affected with organic disease than those of the right. The sounds produced during the systole, are louder than those during the diastole.

"*First*, in relation to the *aortic valve*, if it be obstructed, the murmur will be heard during the systole, will be rather loud, resembling according to Dr. Hope, the whispered letter *r*, and will follow the course of the aorta; sometimes even as high as the carotid, without being perceived, or but faintly so, over the ventricle. If the valve be insufficient, so as to occasion regurgitation from the aorta, the murmur will be heard during the diastole, will be of a lower key than the preceding, resembling, according to Dr. Hope, the word *awe* whispered in inspiration, and will be most distinct over the ventricle into which the regurgitating current from the aorta is directed, though it may also be heard for some distance up the aorta. *Secondly*, in relation to the *mitral valve*, obstruction is indicated by a diastolic murmur, heard over the left ventricle, very feeble and low-toned in consequence of the weakness of the auricular contraction, and the depth of the valve, and compared by Dr. Hope to the word *who*, whispered feebly. *Insufficiency*, producing regurgitation, is attended with a louder sound of the same character, is systolic, and may be heard near the apex of the heart, but does not, like the semilunar murmur extend far up the aorta. *Thirdly*, the same rules apply to the murmurs of the right side of the heart; namely, those of the pulmonary semilunar valve, and the tricuspid. They are usually higher toned than those of the left side, because nearer the surface. They will be sought for, of course, along the direction of the pulmonary artery, or over the right ventricle. They are comparatively very rare." [Wood.]

The auriculo-ventricular sounds, depending upon auricular contraction and the suction power of the diastolic ventricles, sometimes are almost wholly wanting, even where there is considerable constriction of the orifices. The cause of this is the feeble contraction of the auricle. The sounds may occur immediately after

the systole, during the diastole, at which time the suction force of the expanding ventricle operates, or after the period of repose, and just before the returning systole. If the murmur continues during the ordinary period of silence, it indicates a deficiency of one of the semilunar valves in most cases that at the commencement of the aorta, and consequent regurgitation.

To distinguish organic from functional affections of the heart, is often highly important. The pure bellows murmur is an attendant of both forms of the disease. But the *rough rasping* varieties of that sound, indicate some organic disease of the valves. The sounds produced by regurgitation are also in most cases consequent upon organic changes.

By the pressure of an enlarged heart upon some part of the bronchial tubes, a sound is sometimes produced simulating the bellows murmur. This sound is suspended by holding the breath and by this it may be distinguished from the cardiac sound.

1. Pericardial Sounds.—*Friction sound:*—The motion of the two surfaces of the pericardium upon each other, when the membrane is inflamed, and covered by exudations of coagulable lymph, gives rise to a *friction, or rubbing* sound, analogous to that of pleurisy from which it may be distinguished by its continuance during suspended respiration.

A great stiffness and roughness of the membrane give rise to a slight modification of this friction sound, called the *creaking leather sound*, from its supposed resemblance to the noise made by new leather when in motion. The friction sound, like the bellows murmur, may be single or double. It may accompany either the diastole or systole.

2. The *churning* or *washing* sound is sometimes heard in case of an effusion of fluid into the pericardial cavity. This, however, is but rarely the case, and the sound is of little importance. In general these pericardiac sounds are more superficial than those belonging to the heart itself.

Strong pulsation of the heart, by moving the air in inflamed bronchial tubes, may develop the mucous and sibilant rales, and, in large tuberculous cavities, may produce metallic tinkling. On applying the ear to the præcordia, there is sometimes noticed with

the impulse, a metallic ring which is *in the ear of the listener*, and not in the heart. A violent and abrupt impulse causes it.

Irregularities in the rhythm of the heart:—These arise from both organic and functional disease. The debility consequent upon fevers, or upon anæmia may cause this symptom. As a diagnostic sign it is of little importance. Dr. Gerhard speaks of an alteration of the rhythm that is confined almost exclusively to organic valvular disease, and mainly to concretions at the mitral valve. The proportion as well as the normal character of the sounds, is then nearly destroyed, and there is a confused *churning* or *purring* sound. The first and second sounds of the heart cannot then be distinguished, the one from the other. This variation of the rhythm indicates the gravest lesions and is connected with dilatation of the cavities and disease of the valves.

Vascular Sounds.—The movement of the blood in the arteries when their inner surfaces are rough, or contracted by pressure, or enlarged by aneurism, often gives rise to sound. An anæmic condition of the blood favors its production. Indeed, so strong is this tendency in certain conditions of the circulating liquid, that the pressure of a finger or stethoscope upon an artery produces it. It is synchronous with the systole of the heart, and consequently, takes place during the diastole of the arteries. Sometimes a double murmur is produced in the arch of the aorta, the first corresponding with the systole, the second with the diastole of the heart. The diastolic murmur is supposed to be produced by a regurgitant movement of the blood from the great arterial branches in consequence of want of due elasticity in the diseased and dilated aorta. (Bellingham, Lond. Med. Gaz. Sept. 1850, p. 399.) M. Bean thinks that the arterial murmur is caused by an increased wave of blood thrown into the large vessels.

In the *large veins*, and especially in the internal jugular of anæmic individuals, a peculiar murmur is sometimes heard called by M. Bouillaud *bruit de diable*, or *devil's sound*, from the name of a certain humming toy, the noise of which it resembles. It is more continuous than the bellows murmur, is subject to swells and remissions, and sometimes has a slight musical tone.

CHAPTER II.

Section I.

PERICARDITIS.

Pericarditis, from the Greek περικαρδιον, pericardium, and *itis*, denoting inflammation, is a disease which has not until recently been well understood. It is much more frequent than was formerly supposed, and in its termination is often favorable. Late investigations have shown that pericarditis is not much more severe than pleuritis, and that by rational symptoms it is not easily known. The researches of Louis published in the year 1826, have thrown much light upon the obscurity of its diagnosis. The adhesions of the pericardium, so often visible after death, evince the frequency of the disease, and also the frequency of its cure.

But very mild forms of pericardial inflammation may exist, and yet no anatomical lesions be apparent. In a majority of cases the symptoms are not dangerous or severe; they are so only in a minority of instances. So that it very frequently happens that the disease cannot be recognized, except by the physical signs, and even these in its mildest form are by no means conclusive.

Pathology.—The pericardium is a serous membrane, and is also, like the pleura, a shut sac. It is, therefore, liable to similar pathological changes. These in the pleural sac are not necessarily the cause of immediate danger, but in the pericardium they lead to more serious results. At first, the natural secretion is somewhat lessened, and a preternatural dryness succeeds. Coetaneously with this change, a slight deposition of lymph takes place, and this increases until it extends over the surface of the pericardium. In the first stage the lymph is soft, not much thicker than wrapping paper. The lymph on the heart causes a roughness, and an appearance similar to a honey-comb, or according to Dr. Watson, like the rough side of a piece of tripe. The effusion of serum sometimes is great, distending the pericardium, and interfering with the motion of the heart. Sometimes the lymph pro-

duces adhesion of the heart to the pericardium, and thus effects an obliteration of the sac, in which case apparent recovery takes place.

Sometimes serum and lymph and fibrin are mingled together; and, as in the pleura, so here partial adhesions are the result. A copious effusion if not reabsorbed, generally causes the death of the patient in a few days. In cases suddenly fatal, the serum is sometimes clear, often turbid, and tinged with blood, and the membrane presents a fibrinous or albuminous appearance. At the commencement of the curative process the serum is absorbed, the false membranes become consolidated into newly-formed tissue. In favorable cases absorption is often very rapid, the serum quickly diminishing to such an extent as not to exceed in quantity the exudation of lymph.

While the effusion remains and the inflammation exists, the dyspnœa and partial action of the heart may soon terminate life. If the absorption is slow, and no adhesion of the pericardium is effected, the effusion gradually changes to the character of pus. In the majority of cases, however, pure pus is not formed, probably because the patient dies before the suppurative process is fully established.

The redness of the pericardium is similar to that induced by inflammation in other serous membranes. It resembles scarlet specks, and arborizations in the membrane. Sometimes it is stellated in appearance; sometimes uniform, like a continuous stain. The membrane covered with a fine vascular net-work sometimes presents the bright redness of arterial blood.

Pericarditis is rarely complicated with tuberculous disease. In some instances, however, it is met with, and then the pathological changes are similar to those of tuberculous pleuritis.

Diagnosis.—*General symptoms.*—The general symptoms are very obscure. The ordinary symptoms of inflammation usually attend pericarditis, a full enumeration of which will be of no benefit. Those symptoms which more particularly point out pericarditis, are the following:—Pain in the region of the heart, palpitation, pulsation and sometimes soreness of the carotids, a ringing in the ears and vertigo; the breathing is spasmodic, dyspnœa con-

siderable; pulse jarring, jerking and peculiar. The pulse according to Dr. Hope, is the most sure of all the general symptoms to guide the physician to a correct diagnosis. Whenever it is feeble, faltering, intermittent, unequal, this sign, especially if continued, affords evidence of the strongest description.

Fever is almost always present, unless the case is very mild. *Pain* is a very uncertain symptom. It may be a feeling of slight uneasiness, not causing any decided suffering, or very acute shooting from the præcordia to the back between the shoulders, and extending down the left arm, sometimes as low as the elbow or even the wrist. As in pleuritis, so in this disease, the acute pain is most severe in the first stage of the disease, diminishing in intensity as the effusion increases.

Dyspnœa is moderate in simple cases, but more severe in those complicated with inflammation of the internal membrane of the heart, or with pneumonitis and pleuritis.

Cough, in pericarditis, a disease involving the lungs indirectly, is not a prominent symptom unless in complicated cases.

Physical Signs.—In mild cases, and in the early stage, these are often insufficient for accurate diagnosis.

1. *Signs by Inspection.*—The distension of the pericardium, gives rise to an abnormal fullness of the præcordial region. This assumes a pyramidal form, and extends beyond the ordinary limits of the præcordia. Sometimes there is a prominence of the left breast, when compared with the right, and the position of the left nipple is usually higher than the right. A stronger impulse is felt over the region of the heart than is usual. The intercostal spaces are often bulging and tender to the touch. The upper portion of the epigastric region is likewise sensitive to pressure.

2. *Percussion.*—The distension of the pericardium with fluid, causes dullness on percussion. The impulse becomes undulatory, and not exactly coincident with the systole; because the heart must displace the fluid between itself and the thoracic walls before it can impinge upon the parietes of the thorax.

3. *Auscultation.*—Copious effusion impedes the free motion of the heart, and by preventing its contact with the thorax, prevents the conveyance of the sounds to the ear. They, therefore, be-

come indistinct, the degree of the feebleness depending upon the amount of effusion. On account of the increased velocity of the blood, and the abrupt jerking contractions of the ventricles, the first sound becomes even louder than natural, but somewhat changed and altered to a bellows or rasping character. But inflammation confined wholly to the pericardium, seldom gives rise to those sounds, and when it does so, the cause is more in the excited circulation which it induces than in the actual lesion of the endocardium.

In certain stages of pericarditis there is a friction sound, the conditions for the production of which are similar to those of pleuritis. Accordingly, we hear this sound when there is an effusion of lymph, roughening the membrane, and but little serum.

This condition usually occurs at the beginning of the disease, and, consequently, then this sound compared by some authors to that produced by the bending of new leather, (*bruit de cuir neuf*) the creaking leather sound, is most frequent. After the fluid is absorbed and the roughened membranes are in contact, this is again produced. It is then an indication of returning health; because it shows that absorption has taken away the abnormal quantity of fluid, and that the membranes again approach to jutaxposition. This friction sound is sometimes more rough; and then it receives the epithets *grating* or *rasping*. These sounds may be double, occurring at every contraction of the heart, and sometimes according to Dr. Pennock they become treble or even quadruple.

There is a degree of danger of confounding these friction sounds with the valvular murmurs which indicate the existence endocarditis. But the former are more superficial than the latter, are rougher, especially when coincident with the second sound of the heart,—are more apt to change their position with a change of posture, and are inaudible at the distance of two or more inches up the pulmonary artery or aorta, where the murmurs of the sigmoid valves in endocardial inflammation, are heard distinctly, and are not like the murmurs of the auriculo-ventricular valves, uniformly loudest near the apex of the heart.

With the friction sound there is often a vibratory tremor felt by

the hand placed over the heart. Whether this friction sound is caused by the rubbing together of the pleura, or of the surfaces of the pericardium can be determined by the suppression of respiration, which, in pleuritis arrests the sound, in pericarditis it does not.

When there is effusion in the pericardial cavity the washing or churning sound is sometimes heard. This symptom, however, is of minor importance.

The friction sounds may in some instances be confounded with the mucous rales of bronchitis, but the latter cease when respiration is suspended, while the former remain unaffected.

Pericarditis, carditis and endocarditis often exist together.—When this is the case the friction sounds and the valvular murmurs will be produced.

Course and termination of the sthenic form of pericarditis.—In violent cases the disease quickly runs its course, and, in less than forty-eight hours may terminate fatally. In mild cases, it sometimes continues for weeks, not entirely losing its acute character. Ordinarily the disease yields in the course of a week or ten days. Under the influence of energetic and appropriate treatment it may terminate in less time. In case it ends in recovery, the fluid is absorbed, the friction sounds return, respiration and the impulse of the heart become more audible, adhesion is effected and the cure completed. If unfavorably, general weakness, oppression, and the symptoms of imperfect circulation are the premonitors of death.

Section II.

CHRONIC PERICARDITIS.

When the disease assumes an asthenic form, or when the violence of the acute attack subsides, leaving a low degree of continuous inflammation, the term chronic is usually applied. The difference between this and the acute form is one of degree rather than of kind. The symptoms of chronic pericarditis, like those of the acute form, are somewhat variable and obscure. And yet there are certain points of difference, that it may be well to notice. Not unfrequently there is no pain, and the patient com-

plains only of a sense of weight, oppression, or stricture in the præcordia. A little dyspnœa may be present. The pulse is somewhat frequent, irregular and feeble, rather than strong and active. The countenance is of a livid hue, or pale and puffy; there is an absence of the respiratory sounds, they being distant and obscure, dullness on percussion and enlargement of the præcordial region. The impulse too is less than in the acute variety of pericarditis.

This may be confounded with dilatation of the heart, and hydropericardium. But dilatation is usually attended with a peculiar impulse, and increased loudness of the cardiac sounds, but never with the friction sounds. Hydropericardium is without local pain or febrile action, and is usually attended with anasarca and with dropsy of other parts of the system.

The causes of chronic pericarditis are found for the most part in a depraved condition of the blood, in general debility, and in a tuberculous cachexia.

Causes of Acute Pericarditis.—The slighter cases are caused by exposure to cold and dampness. The retrocession of eruptions, suppression of hemorrhages, or other morbid discharges, may give rise to this disease. Scarlatina, erysipelas and granular disease of the kidney, are sometimes connected with its production. Inflammation of the lungs, and its investing membrane is also influential in exciting pericardial disease. Out of 265 cases of pneumonitis, pleuritis, and pleuro-pneumonitis, there were according to Dr. Ormerod, 33 cases of pericarditis. But of all the causes acute articular rheumatism is the most frequent. By the highest authority it is asserted that at least one-half of the cases of acute rheumatism are accompanied with pericarditis or endocarditis, or with both together. Out of 161 cases of acute rheumatism, according to Dr. Ormerod, there were 61 cases of pericarditis. [Half-Yearly Abstract Med. Sci. No. 17, 1853, p. 78.]

The age has some influence upon its production. Persons between eight and thirty-five, are more subject to this disease than others.

Diagnosis.—Pericarditis may be confounded with pleuritis, pneumonitis, endocarditis and pleurodynia. From pleuritis it may be distinguished by the confinement of the dullness to the

præcordial region, by the absence of egophony, by the friction sounds which accompany the movement of the heart, and continue while respiration is suspended.

Pneumonitis gives rise to no projection of the chest, no friction sounds, nor to the altered condition of cardiac sounds. And besides it presents its own symptoms, the crepitant rale, bronchial respiration and resonance, the rusty and viscid sputum.

Pleurodynia has but few symptoms in common with pericarditis, and these are acute pain in the side, difficulty of breathing, tenderness on pressure between the ribs. This has no physical signs which in any degree are characteristic of pericarditis, and therefore, there is no necessity for mistaking this affection for pericardial inflammation.

Endocarditis affecting the internal membrane of the heart itself, must necessarily produce many symptoms in common with pericarditis. And yet when inflammation is wholly confined to the external membrane of the heart, there are signs which with much certainty distinguish it from disease confined wholly to the internal. These are the dullness on percussion over the præcordia, the prominence of the chest, the faintness or distance of the cardiac sounds, and absence of the respiratory. And besides, there are the friction sounds superficial and often distinct, and the purring tremor, and the absence of those valvular murmurs which arise from morbid changes of the internal membrane.

Prognosis.—In general the prognosis is favorable. In its mild form it yields to the influence of remedies very readily. Not unfrequently without any interference from medicine, it spontaneously terminates in health. The treatment adopted by the physician has much to do in determining the nature of the prognosis. If it be that of M. Bonillaud—free and repeated venesection—the physician will seldom lose credit by presaging a fatal termination. Drs. Latham, Todd and Watson, seldom employ the lancet, and their prognosis has been more favorable than that of others In its simple form in all probability Dr. Wood remarks, "it would subside spontaneously, like so many other inflammations under a proper regimen, as relates to diet and rest." The simple cases may in a majority of instances be considered as curable by ap-

propriate remedies. Like all other inflammatory diseases of serous membranes, it often even in its most uncomplicated form, requires a vigorous application of anti-inflammatory agents in order to ward off its speedy termination in death. When it occurs in persons worn out by previous disease, or when it supervenes upon organic affections of the heart or other organs, its termination is generally unfavorable.

If the friction sound ceases after a short existence, and coincident with its cessation, we find decreasing dullness in the præcordial region, increasing steadiness in the action of the heart, and clearness and loudness of its sounds, the prognosis must be favorable. If the friction sound continues for considerable time, it indicates that the amount of effused serum is not great, and that the effused lymph is of so low a degree of vitality, as to prevent a speedy adhesion. If, on the contrary, the friction sound disappears early in the disease, and the dullness increases, and the impulse and sounds of the heart become weaker, and almost invariable, if the pulse at the same time is fluctuating and intermittent, then the prognosis is doubtful. Great dyspnœa, syncope, the sardonic expression of countenance, severe darting pain through the præcordia to the shoulder,—all these, when occurring at the same time, indicate speedy dissolution.

There are two modes of termination, one adhesion, the other resolution. The termination by adhesion has been considered by some authors, among whom was Dr. Hope, as only a temporary cure. This is probably true in relation to those cases in which the deposition of lymph is great, resulting in the formation of a stiff, fibrinous envelope. But this view of the effect of adhesion is not always correct, according to the best and most reliable authority. The effect of pericardial adhesion is similar to that of pleuritic, and as the latter is often present without materially interfering with the functions of the lungs, so the former may exist without producing organic lesion of the heart.

Treatment.—This disease being an inflammation of a serous membrane, requires the general course of treatment adapted to the cure of pleuritis, or peritonitis.

A proper discrimination should be made as to the character of

the disease, whether sthenic or asthenic, and also as to the causes of the disease, whether proceeding from rheumatism, affections of the lungs or of the kidneys. Attention should also be directed to the stage of the disease.

The first object is to remove those exciting causes,—whatever they are,—which immediately produce the inflammation; secondly, to arrest the progress of the local disease; and thirdly, to obviate the ill effects arising from the products of the pericardial inflammation. Among the exciting causes, cold and dampness are frequently found. To overcome their bad effects, a warm or vapor bath followed by brisk rubbing, will very materially aid in arresting the inflammation in its nascent state. Whenever, therefore, any symptoms of pericarditis supervene after a sudden check to perspiration, the first object should be by baths or by diaphoretics, to restore capillary action. For the purpose of promoting cutaneous exhalation, and producing a sedative effect upon the general system, the extract of lobelia pill, should be given in alternation with some diaphoretic compound.

If the cardiac symptoms arise coetaneously with acute articular rheumatism, and are evidently produced by that acid state of the blood which is so characteristic of rheumatic affections, the remedies should be directed to the removal of that condition of the circulating fluid in which the pericarditis has its origin. In such cases nothing will prove so serviceable as a vapor bath, followed by an emetic given in combination with alkalies, and then the administration of leptandria and podophyllin, in combination with neutralizing mixture.

The above course of treatment when adopted before the disease has far progressed, will in most cases arrest its further progress. But if the fever is of a sthenic form, the pain in the præcordia severe, and the friction sounds are audible, and at the same time the patient is somewhat plethoric, no time should be lost in the vigorous application of anti-inflammatory agents. Means should be immediately used to produce general relaxation of the system. For this purpose, administer once in fifteen minutes a pill containing from two to six grains of the extract, or an equivalent quantity in some other form of lobelia, until the muscular system becomes relaxed, the pulse reduced in frequency and the

heat of the surface subsides. A strong sinapism should be placed over the præcordia, or a fomentation of bitter herbs. After the constitutional effects—that is the general relaxation and perspiration,—are produced the remedy may be carried to such an extent as to produce emesis, after which an interval of rest should be allowed. Subsequent to the production of emesis, some diaphoretic powder or anti-febrile remedy should be used.

The surface should be bathed in an alkaline solution, whenever it is dry and hot. In case there is costiveness, a mild cathartic composed of the following articles may be administered.

℞	Leptandriæ virginicæ	gr. xx.,
	Sennæ	gr. xx.,
	Podophyllinæ	gr. i.
	Misce.	

Take in sirup or molasses.

This course of treatment vigorously applied at the beginning of the disease, will usually cause it to terminate in resolution. If, however, the friction sounds diminish, and dullness on percussion increase over the præcordia, and the general symptoms do not abate but rather increase, effusion has probably taken place, and means should then be used to remove the fluid in the pericardium. The third indication, the removal of the products of inflammation should then, if possible, be accomplished. In combination with the anti-inflammatory agents, diuretics should then be used. This compound produces diaphoresis, and diuresis, and may in some cases be used with profit:—

℞	Tincturæ lobeliæ	ʒ ii.,
	Tincturæ digitalis	ʒ i.
	Misce.	

Dose—from twenty to thirty drops once in 8 hours.

By high authority, the following course of treatment is recommended. In the first place, administer medicines to promote absorption into the veins, such as the iodide of potassium, and in about twenty-four hours after produce its removal by free diaphoresis, catharsis or diuresis. In the iodide of potassium, I have but

little faith. A vapor bath, with the internal use of diaphoretic doses of lobelia, and a free administration of vegetable diuretics, will excite absorption secondarily by the removal of the normal quantity of serum from the blood vessels. When the case is of a sthenic form, the administration of the following pill to produce a hydragogue effect, will prove efficacious:—

℞	Irisiæ	gr. x.,
	Podophylliæ	gr. x.,
	Capsici	gr. xx.,
	Potass. bicarbonatis	℈ ii.
	Misce.	

Divide into two grain pills and give from one to two at night and in the morning, if a free hydragogue effect is desired. The diuretics in the chapter on pleuritis are equally applicable in pericarditis with effusion.

In asthenic cases and those of a chronic character, the spirit-vapor bath, should not be so long continued as to cause much prostration. The object is to produce a fullness of the cutaneous capillaries, and to add tone to the general system. More nourishment and mild stimulants should then be given than in the more sthenic forms of the disease. For a counter irritant the plaster and poultice recommended in the article on pleuritis may be used. A plaster applied over the spine, alternately with one over the præcordia is often useful. It should be continued until the podophyllum or *lin*, on its surface, has time to produce its irritant and vesicating effects.

As soon as there is a return of the friction sounds, and an increase in the loudness of the beatings of the heart, together with the general symptoms of amendment, tonics should be used in combination with nourishing, yet easily digestible diet. More especially are these means necessary, when the blood is in an anæmic state, and when œdema of many parts of the system is manifest. In such a condition of the blood, the preparations of iron administered in combination with hydrastis and pupulus will be effectual means of cure. As a general stimulant and diaphoretic and laxative the following pills are excellent:—

℞.	Lob. Sem. pulveris	ʒ i.,
	Capsici	ʒ i.,
	Sodæ bitartratis	ʒ i.,
	Extracti bovis fellis	q. s.
	Ft. gr. iv. pil.	

Dose—from one to three, three times per day. This is a remedy which can be used instead of an emetic. When the pills are continued a number of days they almost always restore the equilibrium of the circulation, and thus tend to prevent those congestions which always precede inflammation; and while they do so they increase the digestive functions, and secure to the patient the formation of the elements of the blood. In case no laxative effect is indicated, the last article in the formula should be left out and the gum acacia used in its stead to form a pill mass.

Patients laboring under this disease should avoid all kinds of excitement, whether mental or corporeal, and live upon such food as is nutritious but not exciting.

CHAPTER III.

ENDOCARDITIS.

The term endocarditis from the Greek word ενδον within καρδια heart, and itis, inflammation, is applied to inflammation of the endocardium, or the internal membrane of the heart. This disease gives rise to alterations in the cardiac valves, and in its muscular structure. In its secondary effects, exist the dangerous results of the disease, rather than in its primary. This is known from two sources. In individuals previously healthy endocardial inflammation very often terminates in structural changes of the valves. And secondly, in those who have died of valvular disease, traces of previous inflammation almost always exist. This opinion, however, is not in strict agreement with that of Dr. Fuller. He contends that the depositions on the valves are due to the presence of an unusual quantity of fibrin in the blood, and to the weak state of solution in which it is held in consequence of that abnormal degree of acidity in the system, which so often accom-

panies or precedes endocarditis. The inflammation may make according to his view, the liability of deposition greater, inasmuch as it tends to roughen the surface of the valves, and in this way tends to favor the adhesion of the particles of fibrin passing along in the current of circulation. From these opposite opinions we may safely conclude that the structural changes are the result of more than one cause, and that medical investigation has not yet accurately determined just how much of the result is due to the influence of the one, or to that of the other. That same condition of the blood which favors the deposition also favors the production of inflammation. So that from one cause,—a general one existing in the blood,—more than one injurious effect arises.

Pathology.—Inflammation of the endocardium cannot on account of the motion of the circulating fluid leave behind all those products which are formed in the pericardium. To the membrane itself we must, therefore, look for the changes resulting from this disease. On examination we find its natural transparency replaced by whiteness and opacity; fibrin may be deposited upon it forming beaded or wart-like fleshy excrescences, and lymph may be effused either beneath or on its surface giving rise to thickening, rigidity, and puckering. In some cases ulceration ensues, giving rise to irregular vegetations, partly consisting of lymph partly of calcareous matter, producing perforations of the valves or a ragged state of their edges, or extending to the chordæ tendineæ, and eating through them and sometimes causing a perforation of the septum ventriculorum.

These morbid changes are found in the different chambers of the heart; but in the majority of instances they are located on the valvular apparatus, or in its immediate neighborhood. The aorta and mitral valves are peculiarly liable to these changes. The right cavities, however, with their tricuspid and pulmonary semilunar valves, are sometimes, though rarely, affected.

The fibrinous vegetations vary greatly in their appearance. They are often very numerous, and vary in size from a pin's head to a millet seed. They are at one time isolated, and at others partially confluent; and when several spring from a common base, they may form a mass of considerable size. Sometimes when

fibrinous accretion has taken place rapidly, its form and appearance is changed, which in other states of the system might have resulted in the deposition of small warty granules along the edges of contact of the valves. In the sigmoid they are arranged in a double crescentic form; but when their growth is more luxuriant, they are more widely distributed over the endocardial membrane.

The surface of the valves is thickly studded with them. On the edges of contact of the valves, they form festoons or fringes; the chordæ tendineæ of the mitral valves are sometimes loaded with an abundant crop of them; and occasionally in different parts of the heart, they are scattered profusely over the entire surface of the lining membrane. The cases in which the last form of vegetations occurs, are just those in which the accretions manifest a strong tendency to decay, and in which arise those formidable erosions and ulcerations to which allusion has already been made.

In color and consistency these accretions greatly vary. They are sometimes gray and friable, sometimes of a pink or reddish color, soft and easily broken down, and can readily be detached from the smooth surface of the membrane on which they are deposited. At others they are less colored and of a much firmer consistency, but still admit of being separated from the membrane; whilst in another class of cases they become perfectly colorless, and so firmly adherent, that they can be removed only by tearing the membrane to which they are attached. At a still later period these warty growths or bead-like accretions cease in many cases to exist as such upon the valves. They become by degrees more firmly agglutinated to the endocardial membrane, and incorporated with the structure of the valve; and merging gradually into one another, until the divisions between the several granules are effaced, they are ultimately replaced by a laminated ridge of fibrin. This is marked at first by serratures, corresponding to the divisions between the original granules, but after a time it also loses all traces of its origin or mode of formation, and becomes smooth and polished like the rest of the endocardium.

Another source of impediment to the circulation in endocarditis is the formation of fibrinous coagula from the blood, which are supposed to contract adhesions to the lining membrane at any accidentally rough or prominent point, and may be seen twisting

about the fleshy columns, and valvular tendons. (Bouillaud.) To these Laennec ascribed the origin of warty vegetations. Dr. Gerhard considers them more frequently the cause than the effect of endocarditis, and ascribes their origin to that fibrinous condition of the blood characteristic of inflammatory disease.

The fibrinous-sub-serous exudation that is seen in sthenic endocarditis is according to the best evidence sometimes changed into a fibrinous, cartilaginous or bony structure. Such a deposition on or near a valve, of course, causes permanent lesion.

During the progress of endocarditis the muscular structure of the heart is more or less affected. But the precise extent of the cardiac lesion it is difficult to demonstrate. According to Dr. Gerhard the heart increases in consistence, and becomes harder than usual immediately after the inflammation of the membrane has ended.

Diagnosis.—*General symptoms.*—The general symptoms of endocarditis are very obscure. So nearly do they resemble those of pericarditis, that an enumeration of them cannot be of much utility. It is sufficient to say, that in general, they are not violent, and that in a large number of cases they are so slight, that the disease is quite latent. In the severe cases, the pain may be somewhat acute, but even then it is dependent upon the attending pericarditis, and the obstruction to the free circulation of the blood. So that in simple endocarditis pain is a symptom so variable, that it cannot be depended upon for the formation of diagnosis. Dyspnœa is another symptom upon which we cannot with confidence rely. It is often violent, causing intense suffering, and attended with signs of obstructed capillary circulation. In such cases, the patient has a haggard, wild appearance.

The character of the pulse is another sign of endocarditis. It is *tense*, though small and irregular. Very great irregularity is indicative of a severe form of cardiac disease, and is usually the result of lesions of the valves. These three symptoms, the pain, the dyspnœa, and the pulse, are the most important, and almost the only ones which are generally attendant upon inflammation of the endocardium. Delirium may arise in the last stage.

Physical signs.—Usually the impulse of the heart is increased,

and irregular on account of the irritation of the organ. Dullness extends over a larger space than usual, and is dependent upon an abnormal accumulation of blood in the cardiac cavities. "This dullness is distinguished from that of pericarditis by the sounds of the heart, being louder and less distant, by the impulse appearing superficial to the sight and touch, and synchronous with the first sound instead of fluctuating." Respiration too, is slightly audible in the præcordial region.

Another sign is the *bellows murmur* either with the first or second sound of the heart. Usually it is heard in a prolongation of the systolic sound; and when it is so heard, and at the same time there are symptoms of acute inflammatory disease, pain in the præcordia, frequent pulse, and palpitation, the existence of endocarditis is clearly characterized. Still more evidence of its existence is added if the above symptoms just alluded to occur in an individual previously healthy, and during an attack of acute rheumatism. The murmur is supposed to arise from partial obstruction or defective closure of the orifices of the valves.

The murmur differs much in its degree of roughness. Sometimes it is soft and almost musical, sometimes harsh or rough, and sometimes so powerful as to mask the ordinary sounds.

Endocarditis seldom exists in an uncomplicated form, being mingled with pericarditis or myocarditis. It is, therefore, impossible to find many cases in which the disease is wholly confined to the endocardium.

For the purpose of aiding those who wish to cultivate accuracy in diagnosis, I give the distinctive features of endocarditis. First, then, by the existence of the bellows murmur we suspect the accession of endocardial inflammation. By the position of the sound, by the direction in which it is heard, by the time of its occurrence. If the murmur is synchronous with the systole of the heart, as before stated in the general description of cardiac sounds, it must accompany the egress of blood from the heart, and must arise either from an obstruction at the aortic valves, preventing the free onward flow of the blood, or from regurgitation through the mitral valve. But if it is coetaneous with the diastole of the heart,—with the ingress of blood into the ventricles,—then it must be caused either by an obstruction in the

mitral valve, or by regurgitation through the aortic outlet. But how can we discriminate between the murmurs produced on opposite sides of the heart? or how refer each sound to its proper valve? These questions so far as the nature of the subject permits, I have already answered in the description of the sounds of the heart. But a brief recapitulation in this connection, may not be amiss. Obstruction at the aortic orifice, is marked by a systolic murmur heard most distinctly at its base, and along the course of the aorta, and by a pulse weak at the wrist. Disease of the mitral valve is indicated by a systolic murmur heard towards the apex and to the left of the heart more distinctly than at its base, by irregularity in the pulse, and inequality in its force and fullness.

The *causes* of endocarditis are very similar to those of pericarditis. It may be excited by injuries, blows, sudden check to perspiration and by mental influences. With pneumonitis and pleuritis it sometimes is intimately connected. But the most frequent of all its causes, is acute articular rheumatism. Some have supposed that the articular affection is transferred by metastasis to the endocardium. Of the truth of this there is not much evidence. The inflammation of the endocardium probably depends upon the same general cause, the existence of too much acidity and fibrin in the blood, that produces the inflammation of the joints. Accordingly we often see the cardiac disease precede or accompany the rheumatic affection of other parts of the system. Mental emotion and irritability may predispose the heart to take on inflammatory action, and thus give rise to the development of endocarditis even before any general rheumatic affection is manifest. Under such circumstances a general course of depuratory treatment, a course whose adoption will remove the acidity and the cause of that acidity from the blood, is indicated; and the idea of removing that condition of the blood by venesection, is one which appears to me utterly destitute of reason or common sense.

Prognosis.—The acute affection under a good course of treatment is rarely fatal, and it progresses to a termination in a week, and in some cases in less than that period.

In violent cases death sometimes takes place in a few days. The cause of so early dissolution has been attributed to the for-

mation of coagula in the cavities of the heart. Other cases although appearing violent, run on a number of weeks before they arrive at an unfavorable termination.

The worst result of endocarditis is the chronic alteration of the valves. It does not, however, follow that cases in which the bellows murmur remains, after the subsidence of the acute symptoms, will necessarily terminate in incurable valvular disease. The exuded lymph is absorbed, and the impediment to the flow of blood through the orifices of the heart, is wholly removed. When it is otherwise, the valvular derangement leads ultimately to lesions which end in hypertrophy and dilatation. The general and rational symptoms indicative of a fatal termination, are frequency and irregularity of the pulse, violent palpitations, distressing dyspnœa, and syncope.

Treatment.—The treatment of endocarditis is almost precisely the same as that of pericarditis. To repeat the several remedies which were recommended in the chapter on pericarditis, would be unnecessary. But a few suggestions relative to treatment, may not be unimportant. Endocarditis involving as it does the membrane reflected on the inside of the heart, and over the surface of the valves, and not being liable to the same effects from the products of inflammation, should be vigorously combatted at its onset. For, if coagulable lymph is to a great extent exuded upon the endocardial surfaces, it will render the deposition of fibrin more probable, and thus will be more productive of permanent organic lesion. The baths and diaphoretics, and the other means to remove that acid and fibrinous condition of the blood,—if such a condition should occur as the effect of rheumatic disease,—should be perseveringly applied. It is best, however, not to administer very large quantities of medicine; for reaction is apt to be excited, and the difficulty increased. It is better to give small but frequent doses, to bring down the arterial excitement gradually, rather than suddenly. The former manner of administration does not so much exhaust the patient, and is not so liable to cause that depression of the heart, which in this disease is always injurious. When the cutaneous heat is great, alkaline bathing will very much aid in the production of diaphoresis.

In cases complicated with pneumonitis and pleuritis, expectorants combined with the general anti-inflammatory remedies, should be given. When the endocarditis is complicated with rheumatism,—and such is the fact in nearly one-half of all the cases of endocarditis,—the remedies for rheumatism should be used, in conjunction with such local means as the exigencies of the case require. If the inflammation is excessive, attended with a full tense pulse, give the extract of lobelia in frequent and increasing doses, until considerable nausea is produced; and let this nausea be kept constant during several hours. After the nausea subsides, in order to secure to the patient rest, a small quantity of extract of lobelia,—not enough to produce sickness,—may be given in combination with acetate of morphine. It is well known to the eclectic branch of the medical profession, that lobelia contains an alkaloid principle, which without doubt makes its use more valuable in this disease. It should, however, be here recollected, that in the low grades of inflammation, in asthenic cases, when the muscular fibre of the heart is evidently weakened, the action of lobelia or of any other powerful relaxing means, is contra-indicated. If given at all under such circumstances, it should be in combination with stimulants in small proportions.

Its complication with pericarditis with pericardial effusion, should be treated with the remedies recommended for the latter disease.

In the treatment of cardiac diseases, certain general principles should be observed as guides to the kind of treatment. Everything which tends to produce an equilibrium in the circulation of the blood, to expel from it those abnormal products which, arising sometimes from unknown sources, cause cardiac disease, is useful. All exciting causes, so far as possible should be removed, and quietness and freedom from mental anxiety enjoined. When the disease assumes a *sub acute* and chronic form, and there is evidence that the valves are implicated to a considerable extent, relaxants should be wholly avoided, and a mild tonic course of treatment instituted. Some alterative sirup given three times per day, and the use of the lobelia and gall pill at bed time, together with small doses of podophyllin or irisin in case the functions of the liver are not properly performed, and absorption is desired, the occa-

sional use of the alcohol and vapor bath, not continued so as to excite the pulse, these are the means most effectual in arresting the progress of the disease, or of postponing its fatal termination. When so great irritability exists that the use of narcotics is absolutely necessary, and when at the same time there is general debility, some tendency to œdema and anæmia, the following compound may sometimes alleviate the symptoms:—

℞	Extracti conii	ʒ i.,
	Ferri carbonatis	ʒ ii.
	M. ft. pil. xxx.	

Dose,—one pill two or three times per day. The quantity should be gradually increased in case the narcotic effect is not at first produced.

CHAPTER IV.

MYOCARDITIS.

The term myocarditis, from the Greek μυς muscle, καρδια heart and itis, is an inflammation of the muscular structure of the heart. Of this variety of cardiac disease, our knowledge is very limited; and it is so because paralysis of muscular fibre appears to precede its disorganization. Of this as a simple uncomplicated disease we know nothing. Extreme pericarditis sometimes extends to the muscular structure, and endocarditis likewise implicates the tissue adjacent to its own locality.

Pathology.—The results of the pathological changes in myocarditis, are first, an injected state of the cellular structure followed by serous or sero-sanguinolent infiltration, and diminished consistence of the muscular fibre. Secondly, a lardaceous transformation of the tissues, giving a homogenous appearance to the structures; the muscular fibres, however, retaining their texture and form. Thirdly, interstitial suppuration analogous to that in the advanced stage of pneumonia. Fourthly, abscess in the muscular structure of the heart. Fifthly, superficial ulcerations, presenting a cribriform appearance. These may be seen on the outer

surface of the heart in connection with severe pericarditis, or on the inner surface, when there is a complication with intense endocarditis.

Diagnosis.—We have no means of diagnosticating any of the forms of suppurative myocarditis. Of other organic changes, such as rupture of the valves, the occurrence of adherent coagula, purulent cysts in the heart, and partial aneurism of the ventricles, we are likewise unable to form a diagnosis. The symptoms of carditis or myocarditis, both general and physical, are so nearly identical with those of other varieties of cardiac disease, that no discrimination between them can be made.

The *causes* are the same as those of other forms of cardiac disease, and the treatment adapted to their removal, is equally well calculated to remove the inflammation of the muscular tissue of the heart.

CHAPTER V.

HYPERTROPHY.

The term hypertrophy, from the Greek υπερ, beyond, and τροφη, nourishment, signifies an abnormal degree of nutrition, resulting in augmentation of the muscular substance of the heart. Before the year 1811, this affection was but imperfectly understood. Corvisart had recognized under the name active aneurism, the hypertrophy with dilatation of Laennec. M. Bertin, in 1811, revealed the most important characteristics of this disease. Later pathologists, have added perspicuity to its nomenclature, but have for the most part confirmed the accuracy of his observations.

Of hypertrophy three varieties are described.

1. *Simple Hypertrophy*, in which the walls are thickened, the cavity retaining its natural dimensions.

2. *Hypertrophy with Dilatation.*—This is the eccentric hypertrophy of authors, in which the muscular parietes are thickened, and the corresponding chamber becomes unnaturally large.

3. *Hypertrophy with Contraction.*—"It has been supposed that the capacity of a cavity may diminish in size as the muscular par-

ietes increase in thickness, or that the hypertrophy takes place at the expense of the cavity."

This is the concentric hypertrophy of authors.

"Of these three forms of hypertrophy, considered in their relation to disease, two only, the simple and eccentric, have any real existence. The third or concentric form never occurs, I believe, except as a congenital malformation." [Watson.]

Cruveilhier first rejected from the number of cardiac diseases, concentric hypertrophy. The physical condition which received this name, he regarded as transient, and dependent upon the mode of death. In the bodies of those decapitated by the guillotine, the heart was found to present that phenomenon which authors have considered an actual disease. He, therefore, concluded that the physical condition named by many pathologists, concentric hypertrophy, was caused by death suddenly arresting the action of an hypertrophied heart "in all its energy of contractility."

Sudden death from hemorrhage, by which the heart is rapidly emptied of blood, may give rise to the appearance of this variety of hypertrophy, by allowing the muscular tissue to contract upon itself. Not unfrequently it happens, that a diseased heart when first removed from the chest, appears enormous, and, that after the removal of the blood from its cavities, it contracts upon itself and greatly diminishes in size.

In the left ventricle this semblance of concentric hypertrophy is most frequent, and is most often present soon after sudden death, while the heart is contracted by the *rigor mortis*. Some authors, however, differ from this. The above cause of concentric hypertrophy, according to Dr. Wood, cannot well apply to all cases; "for" he remarks, "contraction has often been observed in cases of lingering death, and, although by the introduction of the finger into the ventricles the muscular spasm may in many cases be overcome, yet, in rare cases the mechanical dilatation may be the result of expansibility of the tissue, rather than of muscular relaxation."

The first variety, *simple hypertrophy*, is not frequent, as the cavities are usually altered in size. To the ventricles it is confined; for dilatation usually attends hypertrophy of the auricles. In this variety there is no increase in the bulk of the heart.

The second variety, *eccentric hypertrophy*, is the most frequent of all the varieties of cardiac enlargement. Of this authors speak of two forms,—one attended with thickening, the other destitute of it. As the cavities are distended, it is obvious that in the latter, as well as in the former case, there must be an increase in the quantity of muscular tissue, and consequently a real hypertrophy, unless the parietes are absolutely attenuated. Indeed, some attenuation might exist, and the quantity of muscle still be greater than in health.

Pathology.—The degree of enlargement varies from its natura size to three or four times its normal volume. Dr. Clendinning found the average weight in this disease 15 ounces. Its shape becomes more globular, its cavities much enlarged, its position in the chest more transverse, its fleshy columns are stretched and sometimes thickened, its orifices sometimes expanded, and the valves increased in size. Its muscular fibre becomes harder and more resisting, retaining a deep red color when other tissues are pale. Hypertrophy by deranging the circulation produces lesions in other organs. The liver becomes engorged from the impediment to venous circulation. Its acini become enlarged and its color assumes a yellowish tint, and decided cirrhosis follows. Jaundice sometimes supervenes from this cause. Similar effects are observed in the kidneys. The cortical substance is altered, and granular degeneration is produced.

Causes.—Among the more important of these are sudden and severe exercise, mental excitement, rheumatism exciting endocarditis, or any other inflammatory cardiac affection, valvular obstructions, or dilatations.

Diagnosis.—*General Symptoms.*—The additional increase in the action of the heart gives rise to an increase in the force of the circulation. In hypertrophy of the left ventricle the pulse becomes strong, full and hard, the impulse of the heart seeming like the stroke of a hammer. Very frequently the arterial circulation is very much more active than normal; and hence occasional headache, vertigo, epistaxis. Sometimes in severe cases, the face is flushed or of a purplish hue, the features swollen, the eyes

prominent, and indicative of congestion. Apoplexy may be the result of the arterial congestion. In hypertrophy of the right ventricle the symptoms are somewhat different from the anatomical arrangement of the vessels. The lungs and liver, and in fact all the organs immediately connected with the venous circulation, are then more subject to congestion and hemorrhage. Hypertrophy with but little dilatation gives rise to a small, tense pulse. In hypertrophy caused by regurgitation, the cardiac impulse may be great, but the pulse is weak. In this case pulmonary congestion is more liable to occur in consequence of the impediment to the return of the blood from the lungs to the heart, and arterial congestion is less common than in other varieties. Impediments to the circulation of the blood caused by contraction at the valvular orifices may prevent the fullness and force of the pulse. In some cases the degree of the impediment and the increase in the cardiac pulsation are so equally balanced, as to give rise to no marked disturbance in the general system. Regurgitation tends to reduce the fullness and force of the pulse, so that the cardiac impulse may be strong, and perhaps excessive and yet the radial pulse not be correspondingly changed in its character. Disease of the valves usually causes more irregularity of the pulse than occurs from other causes.

From reason we should conclude that hypertrophy of the right side of the heart would cause similar effects in the venous system, that the same affection of the left side causes in the arterial. But this is not corroborated by facts; and imperfect closure in the tricuspid valves permitting regurgitation is supposed to be the cause. The symptoms of hypertrophy of the right ventricle are pulsation of the jugulars, headache and vertigo, a pale, dusky hue of the face, and a purplish appearance of the lips. Dr. Wood mentions, as a very characteristic symptom, a double pulsation of the jugulars, corresponding in strength and interval to the cardiac contractions.

Physical Signs.—In simple hypertrophy there are three prominent symptoms, the increase of impulsion, the dullness of percussion and the alteration in the cardiac sounds. The impulsion is almost always much increased, seeming to give a kind of heaving motion to the præcordia. Its extent is also increased, and more

particularly so when hypertrophy is combined with dilatation. The impulsion is very different from that caused by nervous irritability; that produced by the latter cause being sharp and quick, that by the former more like the increasing pressure of a large mass against the ribs. In every kind of hypertrophy this is a very characteristic symptom.

Percussion is much changed by this disease. The enlargement of the heart makes the dullness perceptible over a much larger space than normal, and, consequently as the enlargement is little or great so is the extent of the flatness on percussion small or great. In the eccentric hypertrophy it is more extended. Sometimes amounting over the centre of the præcordia to perfect flatness.

The cardiac sounds become abnormal. In general the second sound is less sharp, the first more or less prolonged, verging on to the bellows murmur. In complication with dilatation, the loudness and sharpness of the sounds may remain, the dilatation compensating for the deadening effect of hypertrophy on the cardiac sounds. Sometimes there is a prolonged bellows murmur. These physical signs, together with the evidences furnished by the general symptoms, will generally make a diagnosis sure. The increased impulse, variation in the cardiac sounds, dullness on percussion, and the dyspnœa, dropsy, palpitation, will be sufficiently characteristic of the nature of the cardiac lesion. To distinguish between hypertrophy of the right and left ventricle is not always easy. The symptoms of the former are venous congestion of the head, pulsating jugulars, absence of arterial excitement. Those of the latter are already described.

Prognosis.—When dependent upon organic changes in the valves there is little or no hope of a cure. In the young there is much more than in the aged. Usually its progress is slow—advancing step by step to a fatal termination, either suddenly from some casual excitement to the circulation, or slowly from exhaustion and dropsical effusions.

General Treatment of Organic Diseases of the Heart.—It is customary for medical writers to discuss the treatment of each of the cardiac affections separately. To this, the objection may well

be urged, that disease is seldom presented in an isolated form, that in many cases changes, not only in the mechanical, but in the vital state of the organ, are continually going on; and that even with the existence of organic disease, the state of the blood, and of the general system has a potent influence upon the physical signs, and on the results of medication. Nor should it be forgotten that the symptoms of the original organic lesion are often rendered obscure by the great constitutional, or local disturbance, that secondarily arises. Mindful of this caution the practitioner should *look back* of the mere phenomena, to that cause, whether general or local, which is the source of the symptoms.

If the cause be general, as in anæmia, or if it be disease of some other organ, which by sympathy has caused an abnormal condition of the heart, and if, after that continued symptomatic action of the heart has resulted in actual lesion, the same remote causes still continue in operation, then, reason would direct remedial agents to the removal of the remote cause, and at the same time would seek to allay the violence of distressing symptoms; for the mechanical condition of the various parts of the heart, is only *one* object, whose knowledge should at all guide in the prescription of medicine. And, therefore, to lay down treatment which must be changed with every pathological change in the heart, is not only useless,—because it far transcends human ability to tell every one of those changes,—but it is also of no practical importance. Diseases of the heart are in general a series of pathological changes, arising at first from some general cause, and often made continuous by the continual action of causes, similar to those which, at first, produced the lesions.

A knowledge of the *vital*, rather than of the *mechanical* condition should be the guide in practice. A full acquaintance with the various effects, remote as well as immediate of disease of the heart, and of its functional derangements, will enable the practitioner to avoid those egregious blunders in the treatment of cardiac affections, which so often disgrace the profession.

The tendency of pathological science is to engross too much of that attention which should be paid to the treatment of disease. With many physicians the failure is not so much in the amount of learning which they possess, as in the application of that

knowledge to some practical purpose. The physician who would be successful in the treatment of cardiac disease, must bear in remembrance the ascertained facts of pathological science, and found his diagnosis, prognosis, and treatment on a basis that includes all the effects, causes, and modifications of the disease. This is an important desideratum; for the phenomena of cardiac disease are ever varying, so that the vital condition cannot always be determined by the external signs.

In view of these considerations a guiding principle of treatment becomes very necessary in diseases of the heart. Heretofore, cardiac diseases even in their chronic form, have been treated by active depletion, by frequent venesection. Such was the treatment of Laennec, and now the same or a similar course is recommended by Bouillaud and Albertini, and Valsalva.

More modern authors, however, condemn, or very rarely recommend the use of the lancet. Dr. Latham says: "The indisposition to use the lancet in chronic diseases, and in the vast number of acute affections, is one of the best evidences we can have of a safe and scientific practitioner." Drs. Stokes, and Hope, and Pennock, rarely recommend this remedy.

It may then, I think, safely be considered as a general rule,—and in this remark I utter the sentiment of Professor Newton,—that, in cardiac diseases, especially those of an organic nature, no antiphlogistics should be used, which tend merely to palliate for the time, but which secondarily so depress vitality, so impoverish the blood and derange the equilibrium of its circulation, as in the end to do an actual injury. Sedative and diaphoretic agents, the use of frictions, of the warm bath, to determine to the surface, are much safer, and at the same time more efficient in the end, than a decided depleting course.

In general the insufficiency of the valves, a consequent regurgitation or a contraction of the valvular orifices, produce either simple hypertrophy, or hypertrophy with dilatation. Why these effects? Simply because an additional amount of labor is thrown upon the muscular texture of the heart in consequence of the failure of the valves to perform their normal action. In such cases nature, to enable the heart to perform the additional labor increases its muscular fibre,—produces what is called hypertrophy,

in accordance with the general law, that the greater the labor within certain limits, imposed upon a muscle, the thicker and stronger it becomes. If the thickening of the muscles of the blacksmith's arm in consequence of active exercise, is a healthy or normal process, I ask, where is the consistency of calling a hypertrophied heart, a diseased one? or of using depletion in any form whatever to break down those necessary fortifications against the approach of death, which nature constructs?

When the valves are diseased, and their functions either partially or wholly destroyed, how can a heart of normal muscular strength, produce that circulation on which life depends?

The greater the impediment, the greater should be the force to overcome; and on this principle, nature acts; while too often the physician is ignorantly seeking, in every possible manner, to *diminish that hypertrophy*, without which, so long as the valvular obstructions remain, life could not exist. In fact, I honestly believe that the bleedings, starvings, the enforcement of debilitating measures, which formerly were commonly enjoined, have tended to counteract the efforts of nature, and, consequently, have been the cause of immense mischief to mankind.

Instead of this course of treatment, the means employed should be such as tend to strengthen the general constitution, to give vigor to the muscular tissue of the heart, and thus to enable it to carry on its normal functions in opposition to existing obstructions.

A generous diet of animal and vegetable food may, therefore, be allowed. But the use of such beverages as tend to increase the mass of fluids, but not their nutritive properties, should be prohibited. The fear of sudden death, or any other depressing mental influence, tends to injure the patient, and hence, the necessity of its removal so far as this can be effected.

Treatment of Hypertrophy.—The treatment of this disease may be considered under the two general heads,—curative, and palliative. That simple hypertrophy, not dependent upon organic lesion is curable, admits of no doubt. But unfortunately, such cases are rare, while those dependent upon organic disease, are by far the most numerous. Curative treatment is not, therefore, applicable to a great many cases, but the palliative is necessary in

the majority. This, however, should be combined with curative treatment, and, indeed, in many cases this is the most judicious course of medication.

The art of treating hypertrophy with a curative object in view, consists in keeping the circulation tranquil, in preventing plethora by abstinence from too stimulating diet, and yet by avoiding the use of those means which tend to produce anæmia, debility, and their immediate effects. When this desirable state can be obtained, without the production of debility, the heart, like any other hypertrophied muscle, possesses a surprising power of reverting to its normal size. The suspension of its over exertion by such a course of treatment, affords for the organ the most favorable condition of cure.

Remedies may aid somewhat in the attainment of the same object. Whenever the capillary circulation is feeble, the extremities cold,—a condition seldom observed in simple hypertrophy,—frictions to the surface, the use of the bath, and the administration of permanent stimulants, in combination with diaphoretics, will be the most sure to remove the cardiac derangement.

The particular remedies which I would recommend, are capsicum, lobelia, lupulin and asafœtida. These combined according to the exigencies of the case, will be as serviceable as any with which I am acquainted. In case the beating of the heart is excessive, and there is evidence of plethora, the lobelia, and nervines should be increased in quantity, and the stimulant lessened. In cases of the latter kind, such as are attended with arterial congestions, arising from the increased momentum of the blood, consequent upon the powerful contraction of the hypertrophied heart, relaxants, among which lobelia is the most efficient, should be given. The food should then be somewhat reduced in quantity, and strong meats abandoned. Tea and coffee, particularly the latter, are inadmissable, and all causes of excitement, whether mental or physical, should be removed.

For a general remedy, in cases of feeble capillary action, to equalize the circulation, and regulate the action of the heart, the following pills may be used:—

Dose,—gr. i., to gr. iii., as occasion requires. Enough should be given to produce a laxative effect. In connection with this some alterative sirup may often be taken with advantage. The cardiac symptoms are usually in the inverse ratio to the feebleness of the capillary circulation. Means, both hygienic and remedial, should, therefore, be used in order to prevent the congestion of blood to the internal organs. Warm clothing, nourishing, but easily digestible food, the occasional use of a warm bath, not long continued; in short of all the revulsive means—are the principal things upon which dependence should be placed. A life free from excitement of every kind should be led by those afflicted with chronic cardiac disease. When the palpitation is severe and the dyspnœa is great, complete repose should be enjoined. Sinapisms may be applied to the chest, and pediluvia to the feet. Vegetable diaphoretic compounds may often be used with benefit, in connection with asafœtida and scutellaria.

In some forms of heart disease, the kalmia latifolia proves efficacious. Dr. A. Bottom has used a saturated tincture in doses of ten to fifteen drops, or in quantities sufficiently large to slightly affect the sensorial functions, with decided benefit. The probability is that the remedy has the best effect in those cases in which the organic lesions are slight, and the distressing symptoms proceed mostly from functional derangement. A more full trial of the remedy, may reveal its utility as a curative agent.

Counter irritation to the chest and upper part of the spinal column is sometimes beneficial. Various other remedies may be used, but the guiding principle in their prescription should be to prevent the progress of the cardiac changes by directing means to the removal of all exciting causes, and to place the system in that condition most favorable to the prevention of the ill effects arising from the cardiac lesions.

There are several other organic affections of the heart which require a brief notice. Among these is *atrophy*, which during life can seldom be recognized by any symptoms to which it gives rise. Pressure, adhesion, deficient nutrition are its most common causes. General treatment is usually best adapted to prevent its progress, and hence such agents should be used as tend to produce consti-

tutional vigor. Another affection of the heart is *softening*. This is not very uncommon. It changes the appearance of the heart, causing a pale, purplish, or yellowish color of its texture and a great degree of softness of its muscular fibre. It is often complicated with obesity and fatty degeneration. It arises from deficient nutrition, from venous congestion, and sometimes from obstruction in the coronary vessels. Dr. Wm. Pepper found it to accompany the prostration caused by sun stroke. The *general symptoms* are a small, feeble intermittent pulse, feeble cardiac impulse, and syncope. *The treatment* should consist of tonics and stimulants, wine whey, carbonate of ammonia, capsicum, combined with nourishing and digestible diet. Induration of the heart sometimes occurs; likewise ossification, cartilaginous and calcareous deposits.

Fatty deposition is sometimes observed around, and within the textures of the heart. There are two forms of this affection; first, that in which the fat envelopes the heart, pushing the muscular fibre before it; and, secondly, that in which the degeneration commences in the muscular tissue, transforming the muscular fasciculi. These two forms are probably produced by similar causes, and are nearly identical in their nature. It gives to the heart a greasy feeling.

Its symptoms are, feeble, slow pulse, syncope, neuralgic pains in the chest, dyspnœa and coma. The *arcus senilis*, a fatty degeneration of the cornea of old people, is usually accompanied with a similar affection of the heart. The impulse and first sound of the heart is feeble. Tubercles, cysts, hydatids, and partial aneurisms are sometimes observed in this organ. Polypus and concretions of coagulated fibrin are usually found in the right cavities.

The Treatment should consist of mild laxatives, and tonics, and the most permanent stimulants, combined with nourishing diet. There is little danger of using too large a dose of pure stimulants. Brandy even may be borne in larger quantities than in most any other disease.

CHAPTER VIII.

HYDROPERICARDIUM.

This term from the Greek ὑδωρ water, περι around, and καρδια heart, is applied to dropsy of the pericardium. In health there is a small quantity of serum in that cavity, and hence Corvisart considered six or seven ounces necessary in order to constitute disease. It usually accompanies dropsy of other parts of the body. Its most characteristic symptoms are a small, feeble, irregular pulse, lividity of the face and lips, difficulty of dorsal decubitus, and dyspnœa. A variable position of the cardiac impulse has been considered as a characteristic symptom. The *physical signs* are dullness over a large surface, prominence of the præcordia, diminution of the respiratory murmur. When dependent upon inflammation or upon a general dropsical diathesis it is sometimes curable,—but when upon organic disease of the heart, there is little or no hope. *The treatment* should be similar to that recommended for hydrothorax.

CHAPTER IX.

FUNCTIONAL DISEASES OF THE HEART.

Symptomatic affections of the heart are more common than organic, often exciting unnecessary alarm. Functional cardiac diseases assume various forms, at one time so distinct as to be easily recognized, at another presenting such a group of symptoms as to make the diagnosis extremely difficult. The term nervous is applied to several different conditions of the heart. Among these is *palpitation*. Oftentimes this is most excessive, and arises from disorder of the digestive organs, from uterine sympathy, or from excitement caused by excesses of any kind whatever. The free use of tea, and more especially of coffee and tobacco, is a very frequent cause. Violent exercise will often produce palpitation. Anæmia existing while tobocco is freely used, tends in a great degree to aggravate the palpitation, and to develop the

bellows murmur. But this nervous palpitation is not so constant, nor so permanent as that arising from organic lesion. Its access is more sudden, and is more often the effect of some excitement. Whenever, therefore, the physician is making an examination upon which a diagnosis is to be based, the habits of the patient, his temperament, his liability to excitement should be considered. To the free use of tobacco and coffee, I have often traced the cause of palpitations which were supposed, both by patients and even by some physicians, to have arisen from organic disease. Dr. Hope remarks, that one half of the patients who presented themselves to him with the idea that they were suffering from disease of the heart, were suffering from nothing more than *functional disturbance of that organ.* It is, therefore, necessary in the formation of a correct diagnosis, to recollect that the character of organic disease is to progress, that of functional to occur at irregular intervals, that active exercise almost always aggravates organic, but seldom increases the symptoms of the functional; that the physical signs, generally, are soon developed, and remain permanent in the organic, while they seldom exist—and when they do, they result from anæmia or chlorosis,—in the functional, that the organic cannot generally be traced very directly to exciting causes, while the functional often arises from venereal excesses, masturbation, and those other influences already mentioned.

Pain in the heart is often a nervous affection. When very acute, it is more often of a nervous character than a symptom arising from organic disease. Sometimes it is sharp, lancinating, extending from the heart to the spine, and wandering in its character. A general soreness sometimes extends over the præcordia and the integument of the chest.

Intermittence of the pulse is very common. In some this is almost congenital, continuing through a series of years without inducing organic disease. Its intensity greatly varies at different times, and under different circumstances. This symptom, like the former, is an attendant upon both organic and functional derangements, and, therefore, is not a sure guide in diagnosis.

Angina Pectoris.—This has been considered a disease of a neuralgic character, and as separate from all others. It is sup-

posed to have its origin both in functional and in organic disease. The symptoms are extreme pain extending down the arms, usually the left, great dyspnœa, occurring suddenly and produced by some excitement. Ordinarily the attack soon passes off leaving the patient comparatively well, after the endurance of intense suffering.

The *treatment* should be of a stimulating character; pediluvia, sinapisms to the præcordia may be applied, and the tincture of capsicum and lobelia combined with some anodyne should be given internally. Between the attacks, mild stimulants should be used in order to produce an equilibrium in the circulation of the blood. The compound lobelia pills, with a small proportion of lobelia, will have a very good effect.

For palpitation arising from anæmia, ferruginous tonics should be used, combined with stimulants, and nourishing diet. All exciting causes should be removed. Nervines are also useful, and in extreme cases, narcotics. The state of the stomach should receive especial attention, and emetics be given when indicated.

DIVISION III.

AORTIC DISEASES.

CHAPTER I.

AORTITIS.

Inflammation of the aorta has the same characteristics that endocarditis presents; and all the difference there is between them, is in their location. Some authors, therefore, do not treat of this disease under a separate head.

Pathology.—The morbid changes are the same as those of endocarditis, with very slight modifications. The increased velocity of the blood through the aorta, tends to prevent the adhesion of lymph to the lining membrane. Sometimes little ulcers, thickening, cartilaginous deposits, softening of tissues are seen in different parts of the diseased membrane.

Diagnosis.—This is very obscure; the disease being but an extension of endocarditis, the distinctive symptoms are very few. The impulse of the aorta is sometimes perceptible over the course of the vessel. The physical signs are increased impulsion, a sawing or double rasping sound heard at the upper part of the sternum, one part of the sound being synchronous with the onward flow of the blood, the other with its reflux. The *treatment* of endocarditis is applicable to aortitis, and, therefore, no separate description of the remedies is necessary.

CHAPTER II.

ANEURISM OF THE AORTA.

Aneurism from the Greek ανευρυνω, is an enlargement of a part or the whole of the circumference of an artery. They are divided into several varieties, a full description of which is unnecessary. Aneurism of the thoracic portion of the aorta comes within the limits of this work.

Pathology.—The various morbid changes arising from inflammation, such as depositions of lymph, softening cartilaginous deposits, are the usual antecedents of aneurism. It is usually an effect of these several changes, and, therefore, its pathology cannot differ from that given in endocarditis and aortitis, except in its being a more remote sequence of a continued train of pathological changes. The early changes weaken the aortic parietes, and consequently their dilatation follows. This dilatation of course takes place at the weakest points, sometimes producing a little pouch. The inner coat of the artery ulcerates, and the blood presses upon its cellular stricture, dilating it, and thus producing the aneurism. The whole artery may dilate, or some one portion of it. They may be caused by a sudden strain. According to Bizot they occur most frequently upon the posterior surface of the aorta, the proportion being as 103 to 27. Out of 87 cases of thoracic aneurism, 40 were located in the ascending, 31 in the arch, and 16 in the descending aorta. They vary much in size,—sometimes becoming so large as to press upon contiguous viscera.

They cause death in two ways; first, by pressure upon adjacent organs; secondly, by the rupture of their parietes. Their pressure upon a nerve causes paralysis, upon a bone, caries, or its absorption.

Diagnosis.—The signs are a pulsation felt over the course of the aorta, sometimes a thrilling sensation, the sawing sound, dullness on percussion. But these are seldom present in all cases. Among the general symptoms are a thrilling pulse, and neuralgic pain in the chest. It was the assertion of Laennec, that there is no sign pathognomonic of thoracic aneurism except the external tumor, and its truth is now acknowledged by many pathologists.

In many instances a tolerable degree of accuracy may be arrived at, but there is no certainty of the existence of the aneurism unless the sac pushes out the parietes of the chest. Two aneurismal sacs are never exactly alike, and consequently the sounds proceeding from them must be subject to so great variation as to make a diagnosis uncertain when based upon them. When aneurism is suspected, the patient should be interrogated in respect to his occupation, previous habits, the occurrence of blows, falls, or violence of any kind, the interrogator remembering that small aneurisms may exist a long time without producing inconvenience.

The blood vessels of the arm, and the veins of the neck should be examined. The palms of the hands may then be passed over both sides of the chest, for the purpose of detecting an abnormal impulse and protrusion of the thoracic walls. If, on a thorough physical exploration, "an abnormal *bruit* is detected, the effect of position and motion should be tried, and the question asked, whether the *bruit* may not arise from valvular, or other disease of the heart, from a roughened state of the arterial tube, or whether a tumor—probably malignant—may not by interfering with the current of blood, occasion it. Œdema of the hand, pain in the arms and fingers, the condition of the voice, the appearance of the countenance, the character of the pain, state of breathing, hæmoptysis, previous diseases, and hereditary predisposition of the patient, are all important subjects of investigation. Proper attention paid to the above rules, will generally enable the physician to

form a correct diagnosis; but it is easier to say that this disease is not present than to foretell its existence No sounds are pathognomonic of thoracic aneurism. Double sounds, single sounds, in all varieties from the grating noise of the saw, to the murmur of the gentle breeze may be heard, and yet not denote aneurismal dilatation." [Rank. Abs. No. 17. 1853, p. 80.]

Prognosis.—The disease may be considered as incurable by medicine, although aneurism may exist during many years, and not terminate in death. Such cases, however, occur among those of a quiet, placid turn of mind, and among such as are not subject to excitement.

Treatment.—In the discussion of the treatment best adapted to the alleviation of the distressing symptoms of aneurism, nothing more than palliative means needs to be considered. On the one hand, efforts should be used to retard the progress of the disease, on the other to diminish the suffering arising from it. Such means in my opinion, as materially interfere with the condition of the general system, tending in any way whatever to debilitate or to excite the nervous system, are not admissible. It often happens that a patient who has not been the subject of medical treatment, will continue with unimpaired health until he is so unfortunate as to begin to use active means for the cure of aneurism. The patient's mind then becomes apprehensive; his system is weakened; his digestive system injured by starvation. The result is an impoverished state of the blood; in it there is but little fibrin, and consequently it becomes uncoagulable, and the tissues of the vessels unresisting. This want of fibrin deprives nature of the instrument upon which she relies for the repair of the injury; for the formation of coagula in an aneurismal sac is a curative process which should not be prevented. By depleting agents, the force of the aneurismal throb is augmented, and a disease which under favorable circumstances might have continued for years, suddenly terminates in death. The means most effectual for retarding the progress of the disease, are freedom from all excitement, a nutritious and generous diet, the use of some mild stimulant, capsicum, or a moderate quantity of wine. Dr. Stokes re-

lates a case of large aneurism with weak heart, which illustrates the effect of a generous regimen. "The patient, after a six weeks' course of very low living, became almost desperate from the intensity of the pains, the loss of sleep, and the violence of the throbbings. While passing through a city, the thought entered his mind that he would have one good dinner before he died. On entering a tavern he ordered a sumptuous repast of turtle-soup, fish, roast-meat, and wild-fowl. Of these he partook freely. He drank a bottle of Madeira, and two glasses of brandy punch; and declared to me that when he rose from the table, he felt perfectly relieved from all his sufferings. He slept well that night, and continued so free from distress of any kind for many days, that he thought himself cured of his terrible disease." Such a course, however, would not be safe for all cases. Sudden changes in diet are not so well borne, as more gradual ones. In case inflammatory symptoms arise in those afflicted with aneurism, the anti-inflammatory agents should be used for the purpose of palliating the symptoms; but caution should be used in the prescription of any active evacuent remedies. Perfect quiet, the use of some relaxant and sedative agent, will arrest the inflammation; and then other means such as tend to improve the condition of the blood and the general system may be used.

To diminish the suffering arising from aneurism, various external applications to the surface may be made, and the internal use of some sedative, is sometimes admissible. Among the external applications to the diseased part, the most efficient are chloroform, cold water or ice, an irritating plaster over the spine in case the location of the aneurism is near the vertebræ, or a plaster of belladonna, in case the tumor is painful or requires support. Among the nervine and sedative agents, are lobelia, lupulin and the extract of indian hemp. This latter article has been used with success in many cases of nervous diseases; and on account of this I would suggest to the profession the propriety of making a more full trial of its virtues as a sedative agent.

APPENDIX OF FORMULÆ.

DR. NEWTON'S COMPOUND SIRUP OF SANGUINARIA AND LOBELIA.

℞ Sirupi simplicis Oii.; tincturæ lobeliæ ʒ v.; tincturæ sanguinariæ ʒ v.; spiriti anisi ʒ iii.; tincturæ gaultheriæ ʒ iss. Misce.

Dose—one teaspoonful as often as indicated.

DR. NEWTON'S COMPOUND NERVINE TINCTURE.

℞ Sic. Mad. vini. Oii.; pulveris cypripedii ʒ iv.; pulveris scutellariæ ʒ iv.;

Dose—one dram once in four hours.

DR. NEWTON'S DIAPHORETIC POWDER.

℞ Myricæ, zinziberis, populi a a ʒ iv.; capsici ʒ ii.; asclepiadis ʒ i. Misce.

Dose—one teaspoonful once in four hours.

DR. NEWTON'S ANTI-FEBRILE POWDER.

℞ Asclepiadis, ictodis, lobeliæ a a ʒ i. Misce.

Dose—from one half to a teaspoonful once in four hours.

COMPOUND LOBELIA PILLS.

℞ Lobeliæ sem. pulveris, capsici, pulveris a a ʒ.; sodæ bicarbonatis ʒ ii.; acaciæ pulveris ʒ ii. Misce. ft. gr. iv. pill.

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